JULY 1967 35 CENTS

Popular Science

MONTHLY

'68 CARS
Secret Color Photos and Latest News

How to Time Your Car Engine

Machines That Make Money for You

New Deep-Diving Sub: OUR FIRST FERRY TO THE BOTTOM OF THE SEA

19 Smart Tricks with a Router

Breakthrough! New Foolproof Water Paints You Can Use Anywhere

Surprising New Facts About Your Muscles

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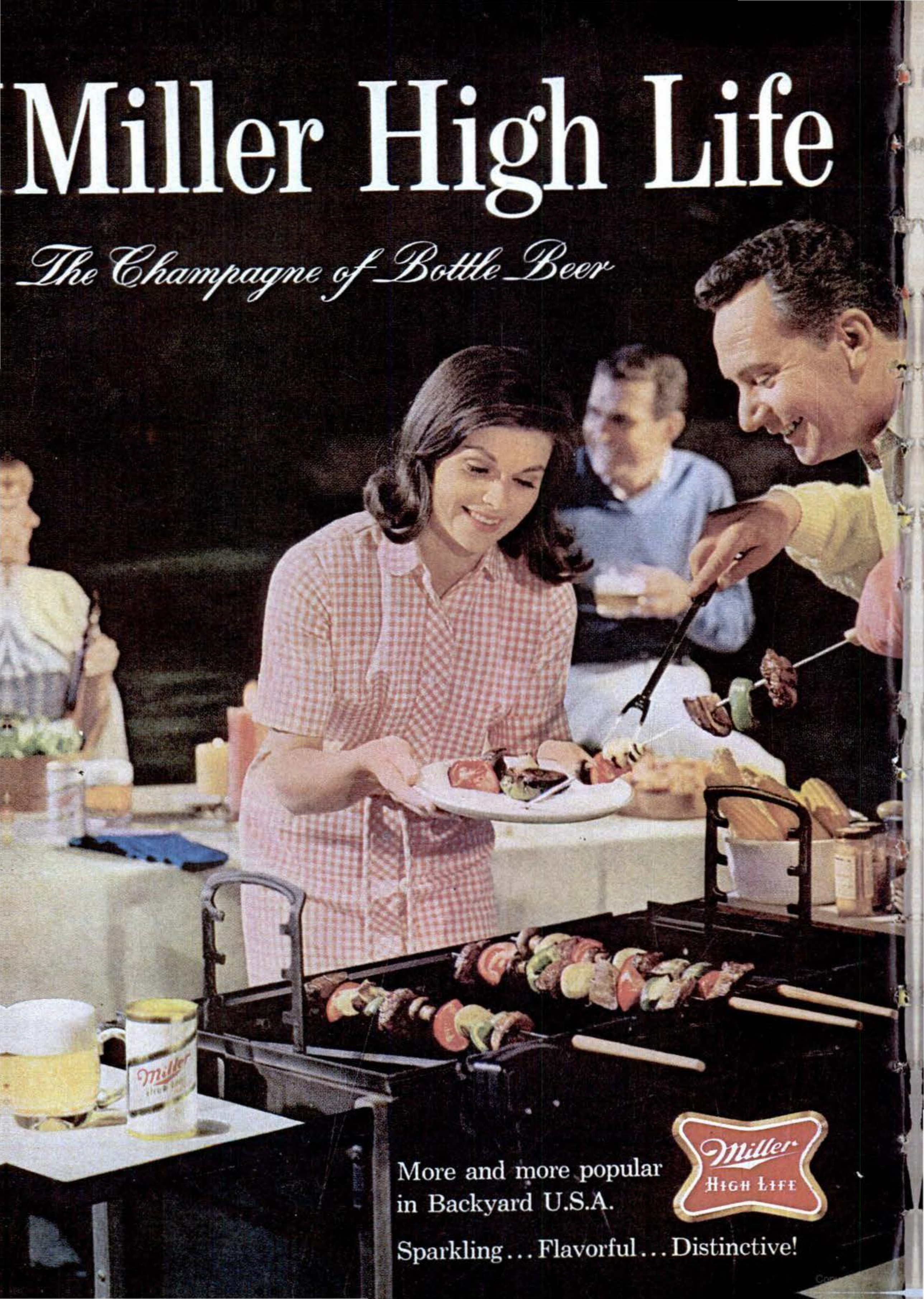

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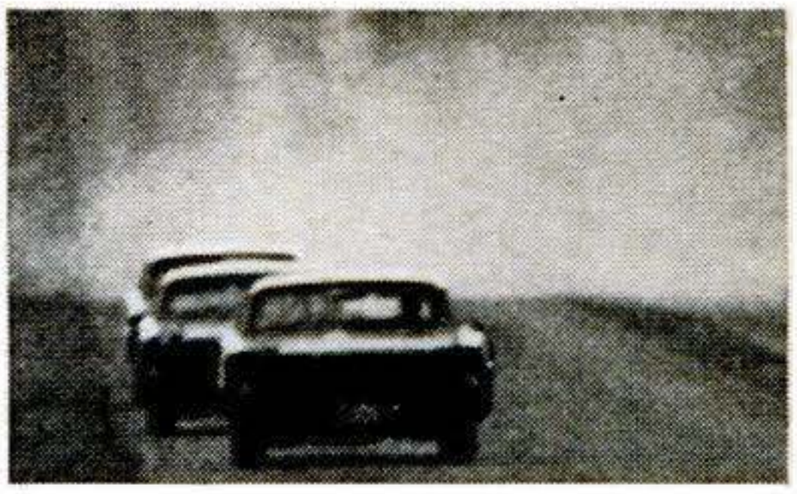

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HIGHLIGHTS OF THIS ISSUE:

Our First Ferry to the Bottom of the Sea PAGE 47

Edwin A. Link, famous inventor and underwater pioneer, tells about Deep Diver, world's first sub that puts out divers to work—and picks them up again.

'68 Cars: Some Chopped, Others Stretched, All Sportier PAGE 50

What's coming up in the new cars? Here's the inside report—plus secret color photos.

Surprising New Facts About Your Muscles PAGE 54

Can you "feed" your muscles? How do you build up endurance? What about warming up and tapering off? Now, science gives you new insights into the human muscle system.

Breakthrough! New Water Paints You Can Use Anywhere PAGE 108

Inside or outside, walls, trim, or metal—there are now latex paints for you. Even enamels!

How to Time Your Sparks PAGE 115

Save gas and gain power with the auto-tuneup techniques you learn here.

COVER PAINTING BY PIERRE MION

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COMING NEXT MONTH

Some magazines offer "something for everybody." A better description of Popular Science would be "everything for somebody." Somebody meaning you—the man who's interested in just about everything in a world full of new things and new ideas. Take the August issue, for example:

- Wernher von Braun tells you about how we'll land on the moon, and The Bug spacecraft that will put us there.
- The auto experts report the hottest news on the soon-to-be-unveiled '68 models . . . The boom in fancy pickups (your next car?) . . . A behind-the-wheel story on what it's like to drive in a stock-car race . . . The ABCs of your car's cooling system.
- And come aboard John Wayne's fabulous yacht, a converted mine sweeper . . . Learn how they get the sound on hi-fi records . . . Things you never knew about beer . . . The inside story on motorcycle engines . . . A surprising new power source: air plus water . . . How to build a beautiful patio, and a coffee-table music center . . . How you can run water lines outdoors . . . And a lot more.

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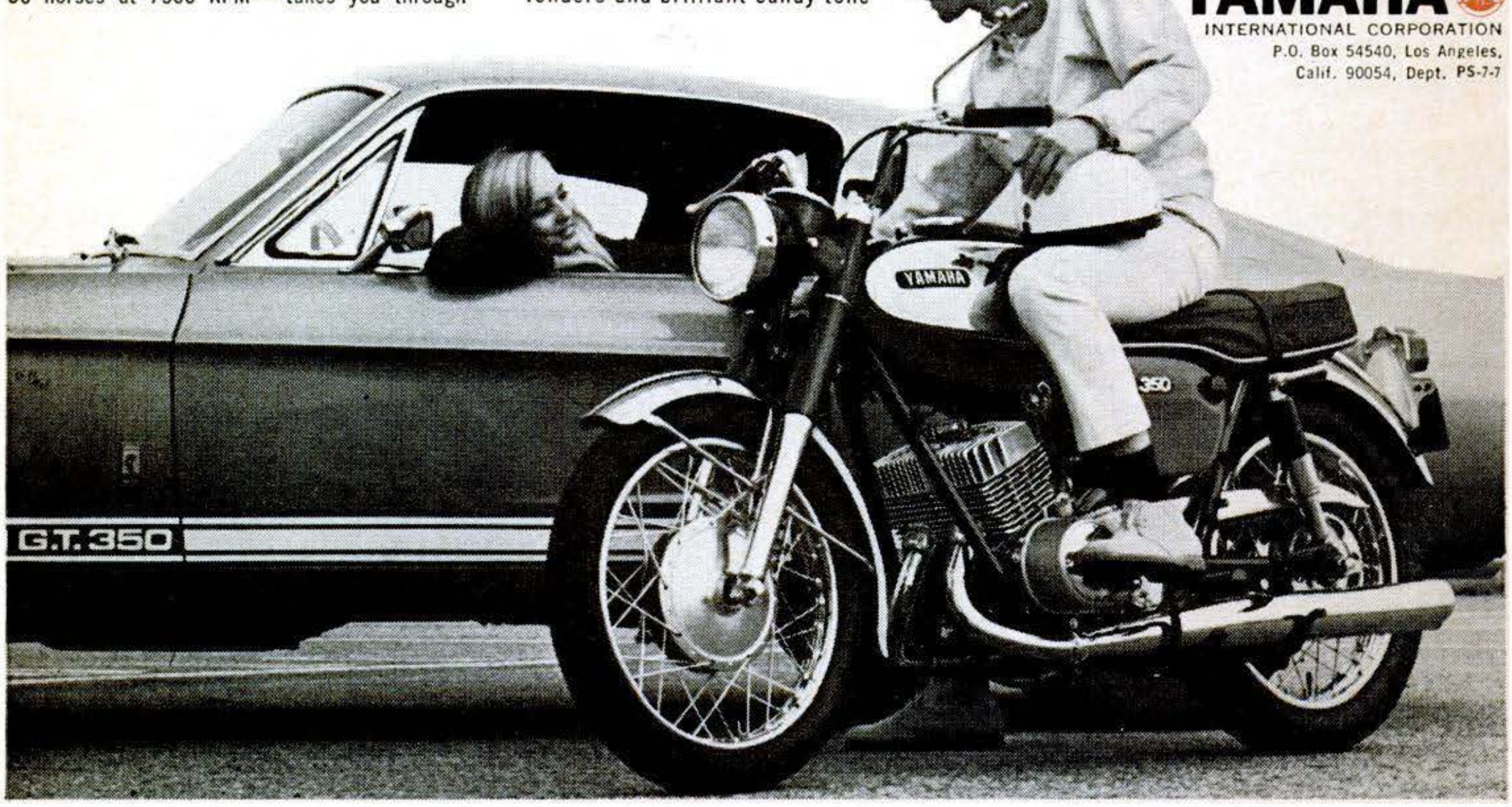

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PS Readers Talk Back

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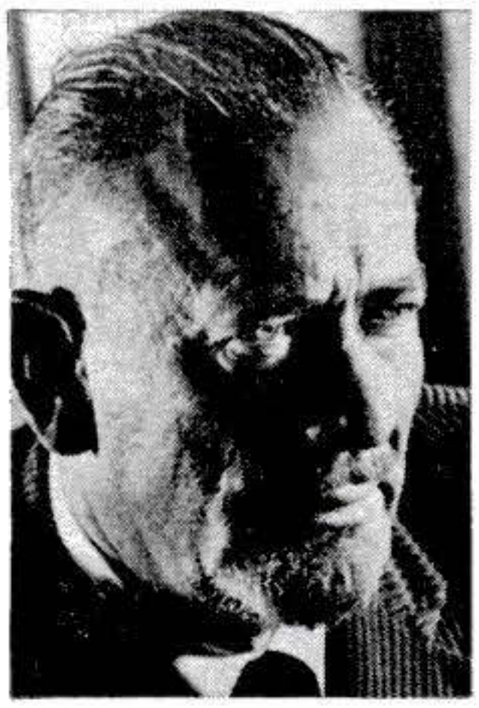
The great camping debate



I enjoyed reading "The Great Camping Debate" [May]. My vote goes to Erle Stanley Gardner. My wife and I have been camping for five years and truly consider camping a family affair. Besides, who ever heard of it raining for three solid days?

RICHARD OELSCHLAGER, Oshkosh, Wis.

. . . I agree with John Steinbeck. Camping is for the birds. The way Mr. Gardner describes camping takes a lot of dollars.

A. SCHROEDER, Boston, N. Y.

. . . The excellent articles on family camping by my two favorite writers mistakenly define camping. Real camping is to live for over a week on what you can carry on your back. This is an incomparable experience.

IAN J. TURNBULL, Willowdale, Ont.

. . . Neither Steinbeck nor Gardner relates the true facts. Steinbeck is right to a degree when he says that people who arrive at state parks in campers ask first for the electricity hookup so they can watch TV. A good way to avoid the side of camping that Gardner dislikes is to avoid commercial campsites. By squatting in state forests or on private grounds, we meet people like ourselves who travel light. We pack a tent, stove, lantern, sleeping bags—and have at it.

J. C. HALBROOKS, Indianapolis, Ind.

. . . Steinbeck misses what I and a good many others consider one of the big payoffs of camping—making yourself comfortable out in the open on a cool night following a hot day, and just looking at the skies above you. You also meet a lot of wonderful people in a campground. You can't find anyone to speak to in a motel.

BRYCE WEST, Omaha, Neb.

ABCs of cleaning spark plugs

"How to Clean and Adjust Your Spark Plugs" [May] omitted the most important part of the plug—the porcelain insulator. The metal parts, including the electrodes, are relatively unimportant and must be severely eroded before engine performance suffers. The internal porcelain should be cleaned with a folded piece of abrasive paper and the external porcelain should be cleaned and polished with a good solvent. The glaze is important since any film absorbs moisture and causes high-voltage leakage. Sandblasting is a fair method of cleaning the internal porcelain, giving good immediate results, but the roughened surface hastens deposit accumulations. The internal plug gasket is also important and is best checked by replacing the plug when a cylinder misfires with normal spark.

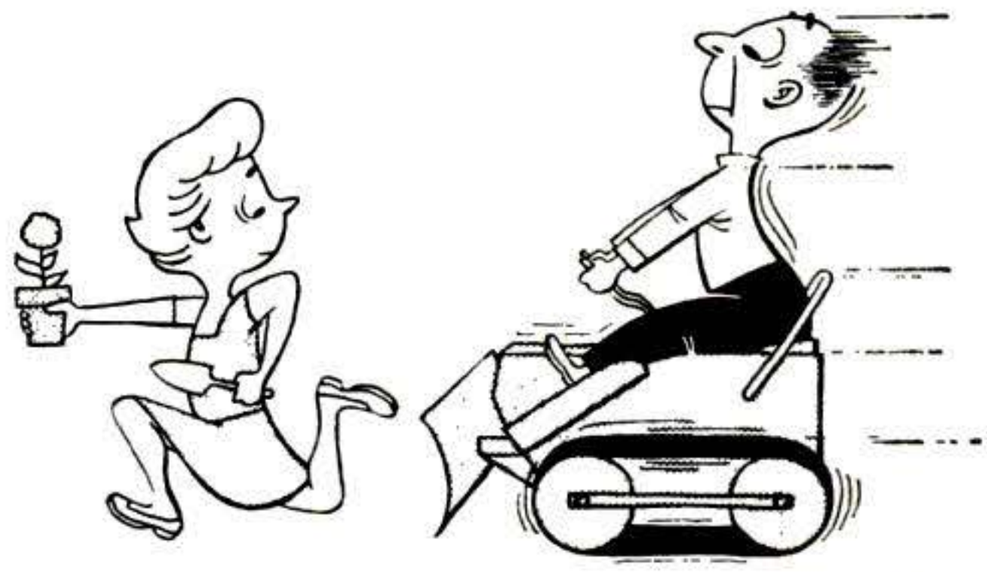
JOHN K. NAGLE, Reading, Pa.

. . . You forgot to mention a most important point: Before removing the plugs, be sure to blow sand and grit from around the base of each plug. Use a small brush, or an air hose. If you don't do this, dirt will fall into the cylinders and damage the engine.

R. CHUBER, Mineola, N.Y.

How do you stop the Mini-Dozer?

In "Midget Yard-Dozer You Can Build" [May], Charles E. Rhine gives a lot of good information on the Mini-Dozer, but leaves out an important point. He tells how it's turned on but does not say how to turn it



off. It sounds like you have to wait for it to run out of gas before it stops.

JIM MORRIS, Kansas City, Kans.

You turn it off by grounding the spark plug.

The Confederacy's only patent commissioner

I am anxious to collect some information on Rufus R. Rhodes of Louisiana, who was the Confederacy's first and only patent com-

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PS Readers Talk Back

[*Continued*]

missioner, 1861-1865. He seemed to drop out of sight historically after the burning of Richmond. Could some PS reader tell me what happened to Rufus R. Rhodes?

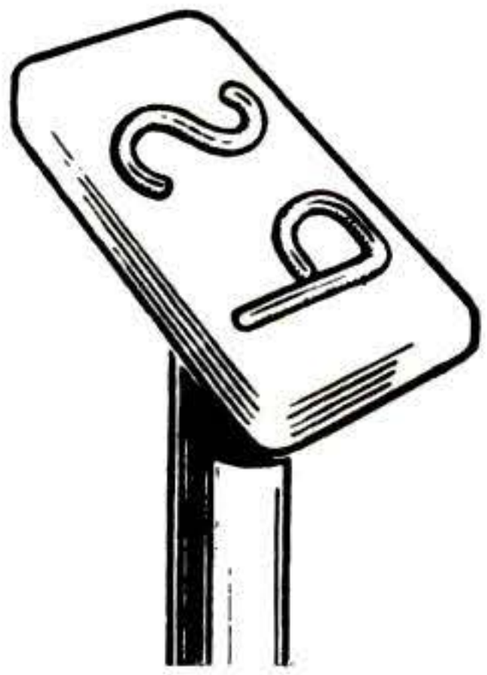
STAN STANTON, Washington, D.C.

What about it, "Rhodes Scholars"?

Hint from the Model Garage

The glove-compartment hint using a beer-can clip in "Hints from the Model Garage" [May] looks like a wonderful way to lose an eye or cut your throat in a collision.

N. E. ROBINSON, Espasola, Ont.



Turnabout—fair play?

Your branding iron in "Short Cuts and Tips" [May] is a novel idea, but wouldn't it be better to reverse the initials on the iron, rather than on the finished product?

PAUL A. FRUZETTI, Nashville, Tenn.

Controversy over air pollution

In the controversy raging over air pollution caused by the automobile engine [May], there have even been suggestions that the internal combustion engine be outlawed. This is certainly premature, because any replacement such as the electric auto will not come overnight. An interim solution is needed. Make the present engine more efficient so it emits less pollutants. I don't think devices that are intended to dispose of unburned gases on the exhaust side of the engine are the answer. For years we have heard rumors about a carburetor that would increase engine efficiency by at least 50 percent. The rumor hints that some oil company bought the invention to keep it off the market. If such a device exists, isn't it about time it was put to use?

KERMIT GILL, Las Vegas, Nev.

This rumor about a supercarburetor has been going around for the past 30 years. No responsible investigator (including PS) has been able to track down the source of the rumor—or any evidence that such a carburetor ever existed.

. . . Very few people are going to pay the price for the new expensive electrics. Why don't they make a car like the Stanley steamer again? It would certainly not pol-

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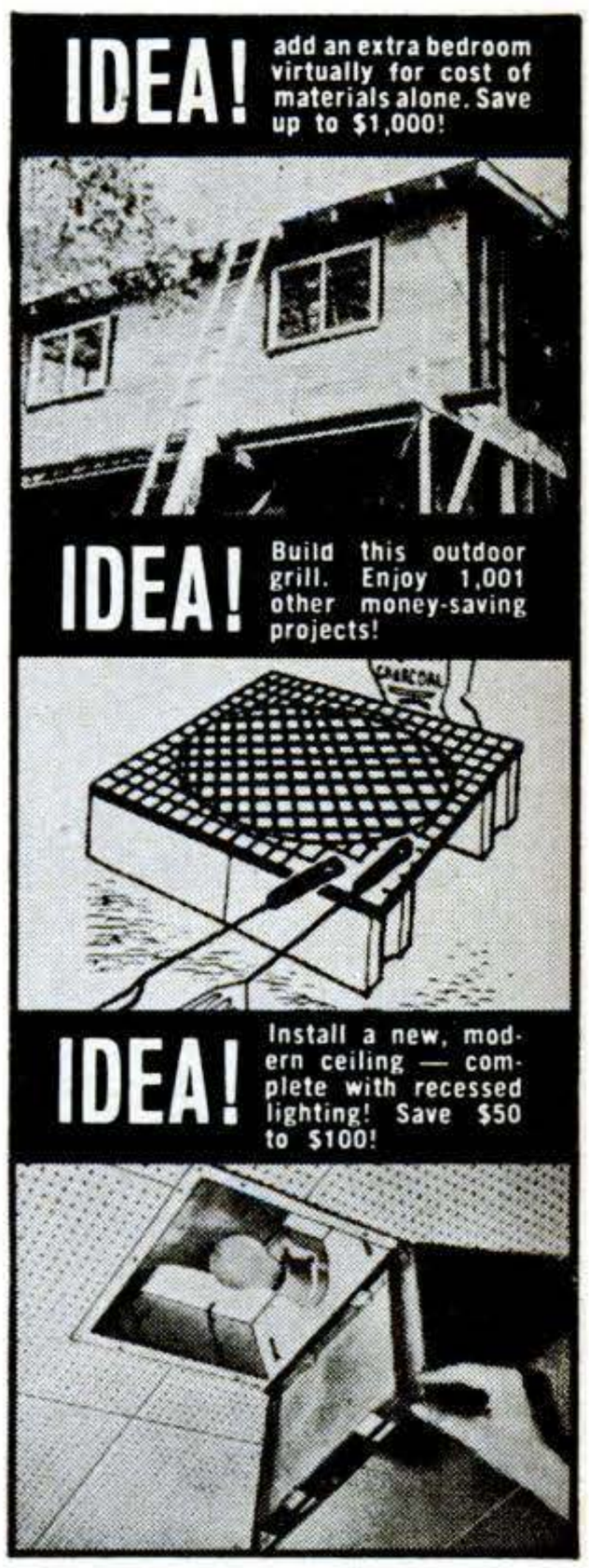

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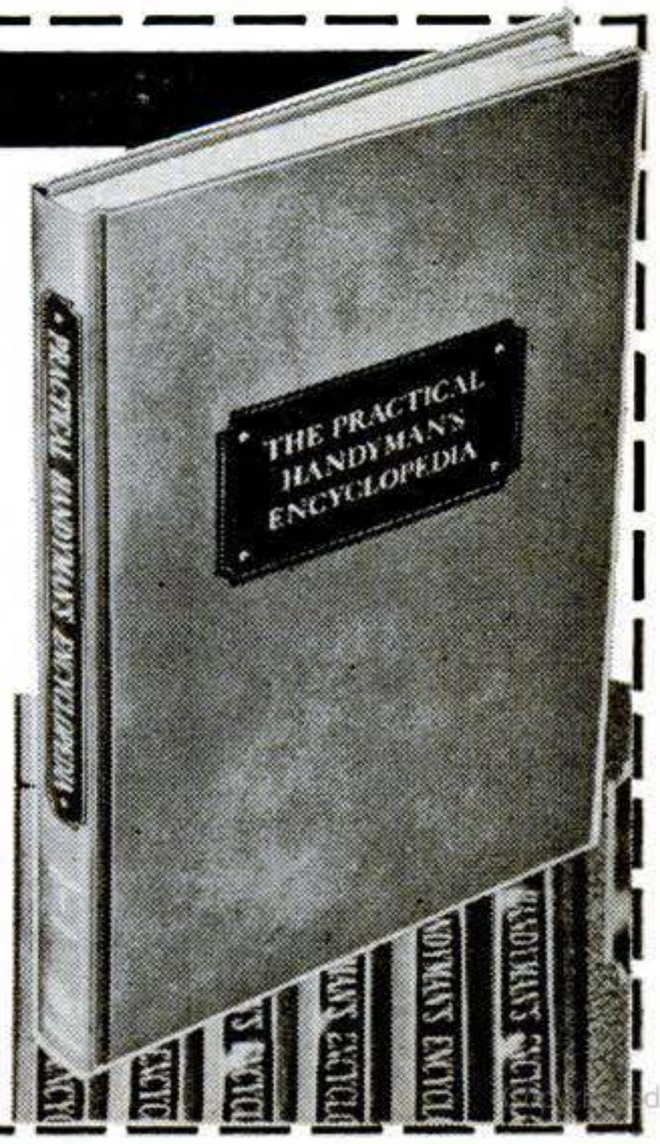

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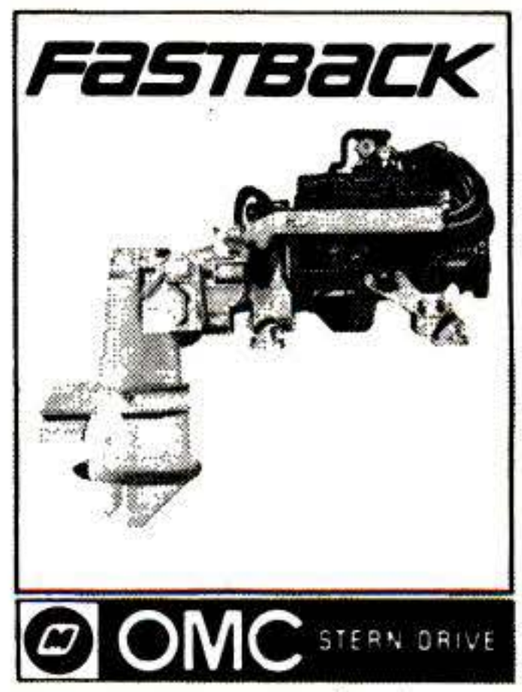

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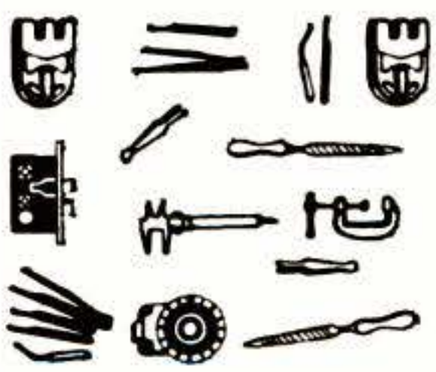

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PS Readers Talk Back

[*Continued*]

lute the air like some of the 300-hp. cars used around our cities. Someone should be able to figure out a way to keep the water from freezing in winter.

ELLIOTT F. STAHL, Yonkers, N.Y.

The solution is easy: build stagecoaches.

Use goggles, gloves for welding safety

The American Welding Society is deeply concerned over the article "Build This Handy Arc-Welding Gun" [Feb.]. Plain common sense dictates the use of flash goggles with side shields, as a minimum safety measure. In every picture the welder is shown handling the gun with his bare hands, a very dangerous practice due to the chance of electrocution.

PHILIP SHEPARD,
Asst. Tech. Director

Author P. M. Wilson, and PS editors agree that tinted flash glasses and light gloves should be used with the gun.

Using a computer at home

Your interesting article "I Used a Real Computer at Home" [May] says that the Teletype Tape Reader could input data at 100 characters per minute. It should have said either 600 characters a minute or 100 words per minute.

R. C. SWANSON, Project Director,
Teletype Corp., Skokie, Ill.

More about UFOs

If your readers who attacked Philip Wylie's "UFOs: The Sense and the Nonsense" [Mar.] would keep up with modern technological information and not totally believe Frank Edwards, they would uncover some surprising facts:

Though there have been ground sightings of UFOs on radar, the computer-operated NORAD radar, which keeps track of all objects orbiting the earth, has never made any sightings of UFOs.

The only unidentified pictures of UFOs are those that show bright, fuzzy objects. The clear pictures have been hoaxes.

Ball plasma can actually fly, dive, climb, track, and perform other maneuvers.

I wish more people would try reasoning instead of building on preconceived ideas.

GERALD WILGAS, Madison Heights, Mich.

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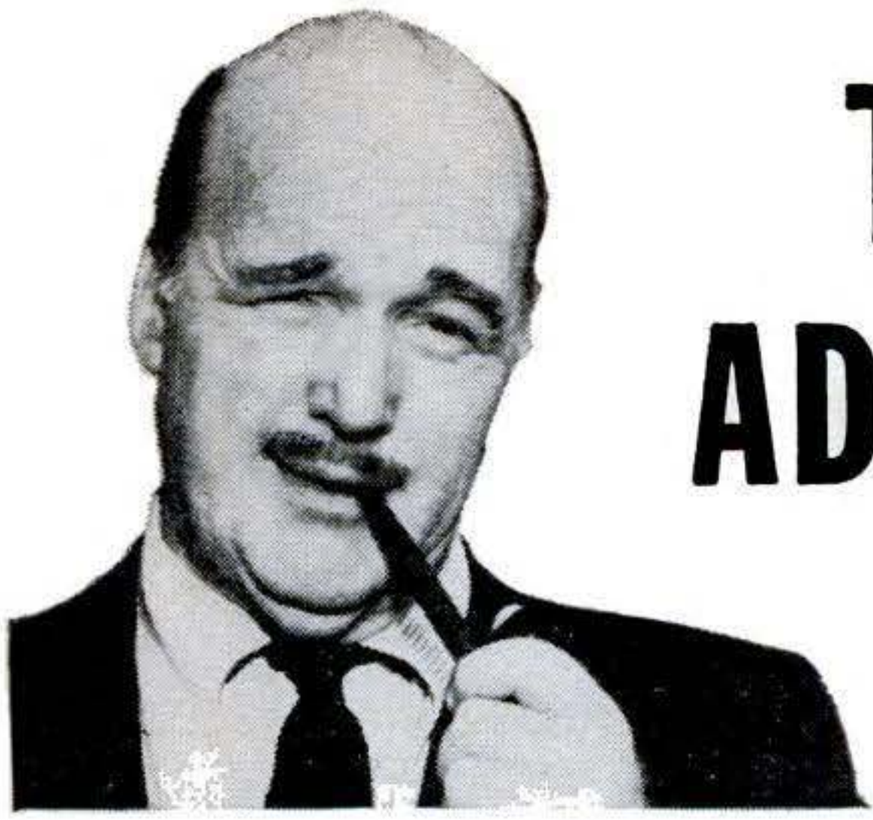

TOM McCAHILL ADVISES SATURDAY MECHANICS

If you're a Saturday mechanic, my guess is you can fix the screen door, build lawn furniture, overhaul the kid's bike, and rotate your own tires.

It's a different story when that fancy electric coffeemaker stops perking or the push-button automatic washer quits halfway through a cycle. You might spend an afternoon admiring the coffeemaker's innards before giving it a permanent vacation on the top kitchen shelf.

As for the automatic washer, after the Little Lady shouts "Do something!" you'll end up phoning an Appliance Serviceman across town. He shows up in 3 days and has the washer going in one-fourth the time it took you to study the coffeemaker. He also presents you with a ticket for 30 bucks. When you consider he could make twice that selling you a new machine, you got off easy.

Maybe you never realized it, friend, but you have more Appliances around your hacienda today than you did five years ago. If you count power tools, your wife's hair dryer, an air conditioner, plus the standard stuff like vacuum cleaner, toaster, refrigerator, freezer and so forth, you probably have well over a dozen.

These electrical gadgets nowadays represent a pretty good chunk of your hard earned dollars. Did you ever stop to think it could pay you in savings and convenience to know how to fix these things? Also, it could be a great source of extra income if you're inclined to tackle the few thousand broken Appliances right in your own neighborhood.

The Appliance Repair business is easier to learn than you imagine. The National Radio Institute's Appliance Division has a downright interesting, low cost course you can take in your spare time. It covers every type of Appliance you can think of plus air conditioning, refrigeration, house wiring, electric motors — even small gas engines. There's a worthwhile section on farm and commercial appliances too.

NRI starts you with the basic principles of electricity to give you a solid background. Using clear-cut picture diagrams, they show you how various types of Appliances work, separating each into groups. Included with the course is a topnotch, professional Appliance Tester for fast troubleshooting.

Easy to read, bite-size lessons are loaded with photos and cutaway drawings so you see how each Appliance comes apart, and more important — goes back together in working order.

Whether or not you agree that knowing Appliance Repair could help you, I recommend you see for yourself. The coupon below will get you a free book that fully describes this unique home training. No salesman is going to call.

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Tom McCahill

TOM McCAHILL

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"Say, Smokey—"

A clinic on cars by America's most famous mechanic

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Ask Smokey. You'll find the address at the end of the column. Please *print* your name and address.

Lee Petty, former great of the stock car tracks, and Smokey exchange ideas.

"When I drive my '56 VW more than three miles with either the headlights or parking lights on, I can't stop the engine unless I turn off the lights first. Only then will the ignition switch turn off the engine."

DAVID H. MCKEE, Sparks, Md.

Drive it with the lights on in the daytime until it acts up. Then go to a good VW dealer or an electrical shop. Have them check to see why the headlight circuit is feeding juice to the primary side of the coil. I think you'll find this interconnected with a generator-circuit miswiring. Or maybe heat in the ignition switch is creating a short.

"A local carburetor and ignition specialist whose opinion I value suggests that I'd raise the gas mileage in my 1966 Olds Dynamic 88, with 425-inch engine and two-barrel carburetor, by three m.p.g. if I enlarge the air-cleaner inlet. He claims the engine is starved for air at this altitude—5,300 feet. My dealer said I'd nullify the warranty if I disfigured the cleaner. I don't care about the warranty. I just want all the performance I can get without hurting the engine."

ALLAN LUND, Riverton, Wyo.

Let me go at this cautiously. If you were not at that altitude, I'd say don't tamper with the inlet. But up there, your specialist friend may be right. The message I want to leave with you is this: Be sure you can return the inlet to the original specs if he's wrong!

"My '65 Chevelle SS with 283-inch engine and four-speed manual has a consistent thumping sound. It seems to be right under the transmission hump through the middle and front of the car when I have two or more people on board. I've had this trouble since the car was new. The dealer can't fix it. I even put overload springs in the rear. It didn't help."

DON MESTEMACHER, Webster Groves, Mo.

Sounds as if the engine bell housing is hitting the floor. You'll probably find your trouble in the engine mounts.

"My '62 Ford Fairlane has abnormal blow-by, yet I burn only a quart of oil each 1,500 miles. The oil-filler cap and breather pipe are clear. Various kinds of additives have proved to be no help. Flushing the engine didn't reduce the embarrassing air pollution."

CARL PARDUCCI, Bronx, N.Y.

There are lots of things you could try, but with a vented crankcase, you've got only one sure fix. Have the engine pulled out, cleaned up inside, and thoroughly overhauled. Anything short of that is a waste of time and money.

"The original limited-slip differential in my '59 Rambler Rebel worked very well, but finally developed a noise that the dealer couldn't get out. So he replaced the entire rear axle. This has never worked right. Can you suggest any adjustments or repairs I can make?"

ROY MANNING, Bountiful, Utah.

In the early days of LSD (and I don't mean that stuff the nuts take), it wasn't long before the device began slipping. Even in late-model cars, it is apt to be noisy on slow turns. All you can do is use the right grease, have the clutches checked for correct assembly, and load according to specs.

"Our '66 Ambassador, with the 287-inch V-8 and about 5,000 miles on it, diesels

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"Say, Smokey—"

[*Continued*]

now and then. The dealer's mechanic says this is normal—there's no cure. Is he right?"

STEVE BOSCH JR., Pollock, S.D.

No. You can fiddle. You can drop the idle speed to a minimum. I'm sure your Rambler dealer can make a series of adjustments in the carburetor that will help. Premium gas helps. Sometimes timing readjustment helps. But if you have a set of cylinder heads with sharp edges in the combustion chamber, or a gasket dangling inside—as I suspect—the fix is obvious. As I've said many times in this column, these things cause pre-ignition.

"I have a '63 Pontiac Tempest Four with automatic transmission and transaxle. Can I swap for a V-8 without too much trouble? Would it be practical?"

RONALD D. BEHRENDS, Madison, S.D.

Yes, if you use the small V-8 that Pontiac had as an option on that model. The extra power will be a little hard on your drive line and transaxle, though.

"My '65 Dodge with 383-inch engine and Carter AFB carburetor doesn't have power steering. At $250, a dealer installation is a little high for me. I was thinking of buying a used unit, but haven't been able to find one off a '65 Dodge. How far back would I have to go in the Chrysler line for one without too many fitting problems? Is it possible to install one from another manufacturer? You mentioned variable power steering to a Corvette owner [PS, 'Nov]. Could I get the same? What make and year of car would have that kind?"

Q. C. DREISSEN, Winnipeg, Can.

Better stick to a unit designed for your particular model—unless you have lots of tools, and time means nothing to you. Room is at a premium under today's hoods, and you could wind up with plenty of trouble and lots of expense. Variable-ratio power steering is best, in my opinion, but it's still very expensive to install unless designed for a specific car.

"A friend tells me that to get a quicker warmup and greater fuel economy in my '66 Impala 283-inch V-8, I should connect a piece of flexible tubing to the tube of the air filter and fix the other end near the exhaust manifold. It would draw in warm air. Is this true?"

WALTER E. OGDEN, Providence, R.I.

Don't do it. You might gain one or two advantages, but they won't offset all the dis-

Continued

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Why your wife needs a phone in your workshop

Chances are she's down in her laundry room as often as you're in your workshop.

So with an extension you're both spared that dash upstairs every time there's a call.

By the way, if she wonders why you're putting her phone in your workshop, point out that she can talk more comfortably when she's away from that noisy washer.

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"Say, Smokey—"

[*Continued*]

advantages you'll suffer. This idea is now being tried by several car manufacturers and it works well, but their engines are designed for it.

"My '66 Mercury nine-passenger Colony Park has an unusual lurch, or wander, at turnpike speeds. This has not been cured by wheel balancing, alignment, steering adjustment, or new shock absorbers."

ROBERT M. HAMILL, M.D., Keene, N.H.

Many of today's cars have this problem. I call it "lateral instability." It's usually exaggerated at higher speeds in crosswinds. The ailment is brought on by the public demand for a softer ride and high styling. The fix would be wider, harder, low-profile tires, and a stiffer sway bar, springs, and shocks.

"The power brakes on my '67 Skylark have such a soft pedal touch that they are dangerous. I'm afraid to use the car in wet weather, or in the winter months at all. The dealer pulled the wheels and rubbed the linings with emery paper. It did not help. I suggested to the service manager that he disconnect the vacuum unit, but he said that would give us reverse trouble—a too-hard pedal."

CHARLES MCK. BOSTDORF, Harrisburg, Pa.

This is not a job for hit-or-miss fixes or guesses. Have your dealer call in a Buick factory service representative, and let him solve the problem. Power units are touchy things when it comes to input effort and output performance.

"I have a '66 Catalina station wagon that I bought complete with air-conditioner and trailer package equipment. In the summer this car overheats badly on slight grades. It seems to me that I don't have enough radiator capacity for the load with a trailer."

H. O. PAULSON, Lincoln, Nebr.

I don't think you have enough radiator either. The simplest way out would be to have a radiator shop build you a bigger one, then put in the largest fan and shroud Pontiac makes. Then you should have the engine checked against any damage suffered from previous overheating, and restored to specs. Make sure you haven't blocked your airflow with any bolt-on gadgets.

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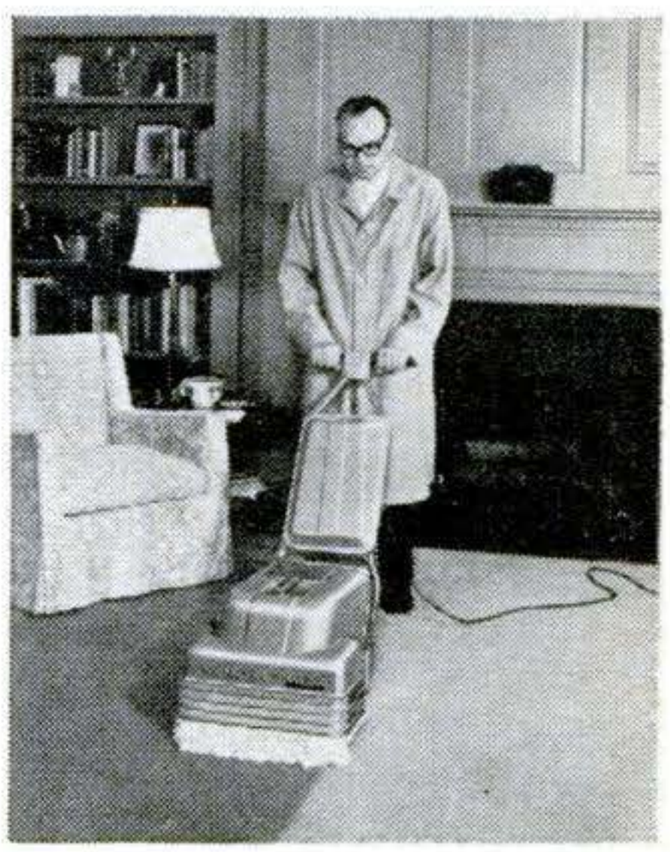

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Detroit Report...

FORD IS SECRETLY DEVELOPING A MINI-MUSTANG for 1969½ introduction. The new car is code-named Delta and plans call for it to be built on a 104-inch wheelbase (compared with 108 inches for the Mustang). Delta is a fastback coupe with an even smaller back seat than the Mustang's. I call it a Mini-Mustang because it will use many Mustang underbody parts and is expected to share most of Mustang's mechanical components. Ford is reportedly aiming for a basic price of $2,000, stripped.

Ford's Delta will go into production just one year after American Motors' AMX comes out. Both of these cars are aimed at the market section below the compact specialty cars. There is no doubt that Chrysler Corp. and Chevrolet will also introduce sporty cars of this size, but how far along they are in their planning is not known at this point. While Chevrolet is reluctant to add another model to their overcrowded lineup, Chevy could easily alter the Corvair to fit into the new group. Meanwhile, American Motors' AMX will enjoy a tremendous jump on the rest of the industry.

What about the other '69 models? Auto insiders say you'll see more changes in the '69 and '70 models than in any other two-year period in history. The low-priced three—Chevrolet, Ford, and Plymouth—will get all-new sheet metal. The big Ford will have a two-inch-wide band of flat sheet metal outlining the top half of the wheel openings and stretching along the widest part of the car from bumper to bumper. Chevrolet's wheel openings will have a concave teardrop design intended to make the car look longer and lower. The Mustang will be all new, too, and its appearance will be radically different for '69. The rugged, stubby look will be replaced by more-sweeping horizontal lines to make the car look longer and lighter. There will also be a revised Cougar. There will be new models from Lincoln and Mercury [see last month's "Detroit Report"]. The big GM cars and the Chrysler line will also be completely redone for '69, but I have no details on them yet. A major change will take place on the Toronado and Riviera models, with four-door bodies added to the line. At the same time, Ford is expected to unveil a convertible Thunderbird.

Uniroyal's automated test track at Laredo [PS, Nov. '66] is now in operation, and speeds of 140 m.p.h. in driverless cars will be realized this summer, according to sources inside the company. Uniroyal is now testing a new Fastrak wide-tread tire at Laredo and will introduce it later in the year.

Ford's electric car is actually two cars. One is the British car that uses lead-acid batteries; the other is an American version of advanced electromotive design. Ford of Britain's car will be used by the company as a test-bed of the present state of electric-drive cars. It was designed for short lead time with proven components. By American standards, the car is underpowered, has inadequate range, and is too heavy to be efficient. The American Ford electric will test more exotic power sources and is aimed to meet the demands on a small commuter-type vehicle. Ford hopes this car will run at 60 m.p.h. for half a day with long-life, lightweight batteries that can be recharged in a few hours.

Curtiss-Wright's rotating-combustion engine [PS, April '66] has recently completed a 1,500-hour cyclic endurance test. Oil seals were changed twice, after 120 and 500 hours. The final oil-seal configuration was in operation for 1,000 hours. The test was interrupted at 837 hours because of rubbing between rotor and housing. The program was resumed and no further failures occurred. Completion of this test (under military supervision) proves the ability of the RC engine to meet power-generation requirements in respect to both economy and durability.

Comotor is the name of a new company in Luxembourg, formed by NSU and Citroën for the manufacture of Wankel engines. Since 1965, a Swiss subsidiary of NSU and Citroën called Comobil has been planning new RC-powered cars for world markets.

Jim Dunne

Detroit Editor

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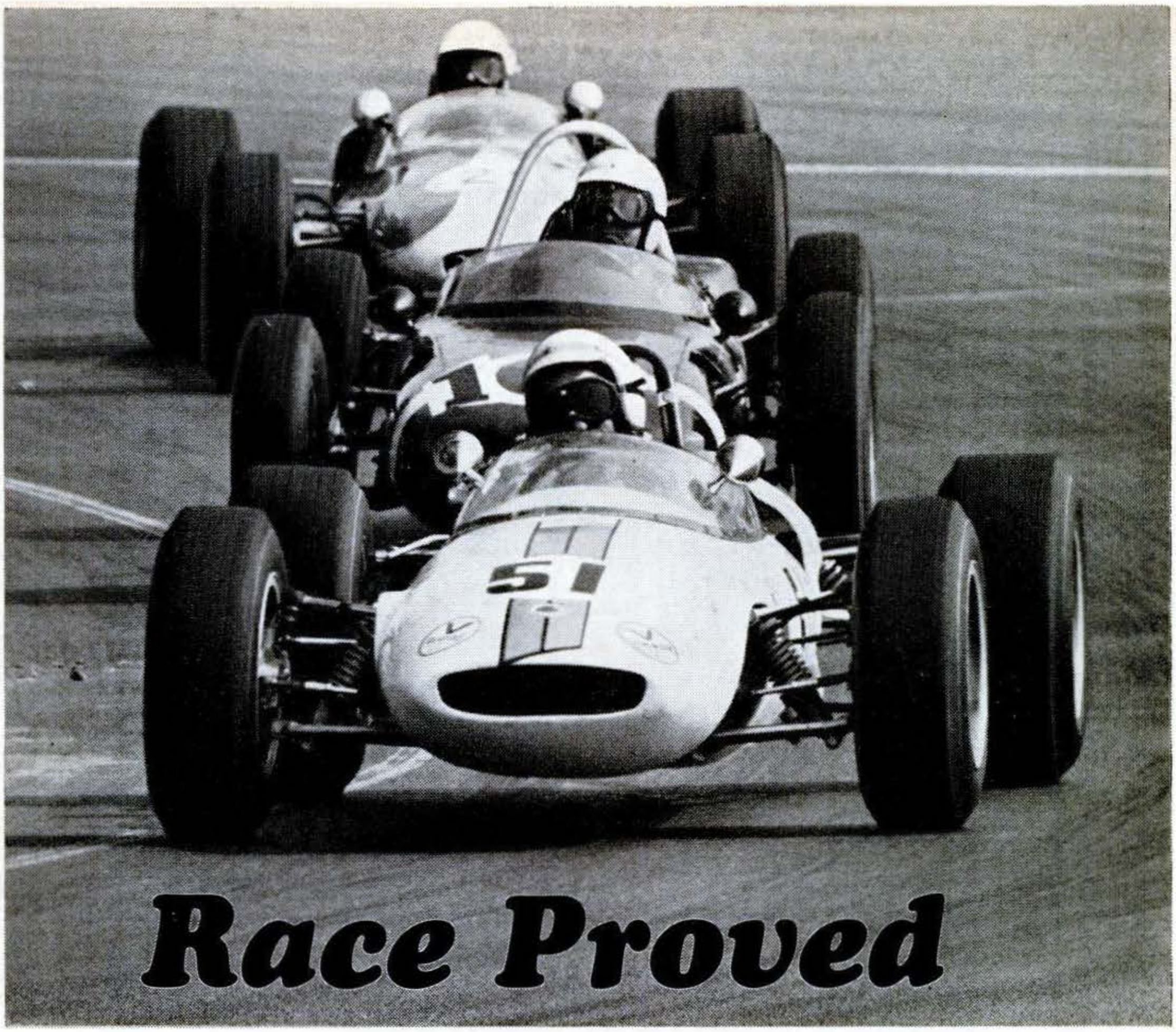

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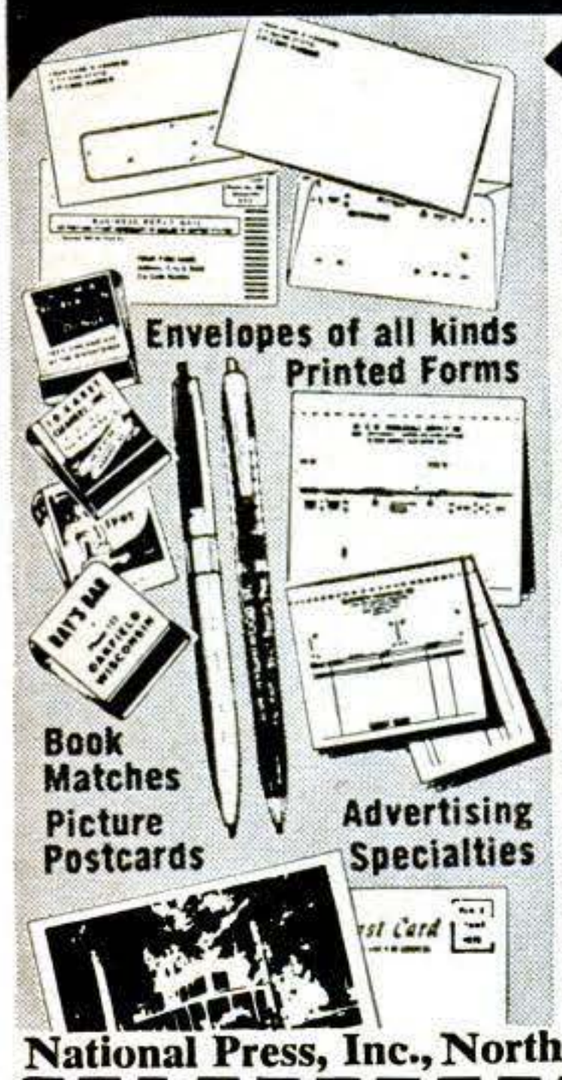

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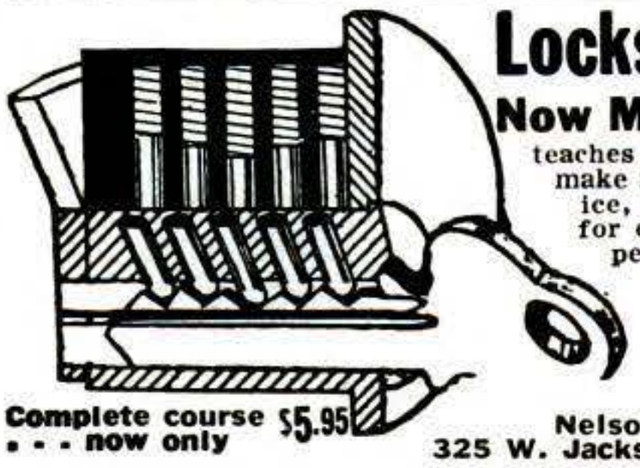

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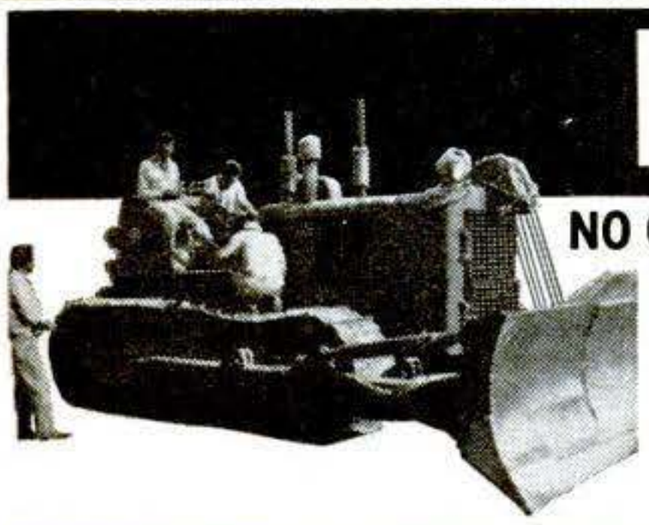

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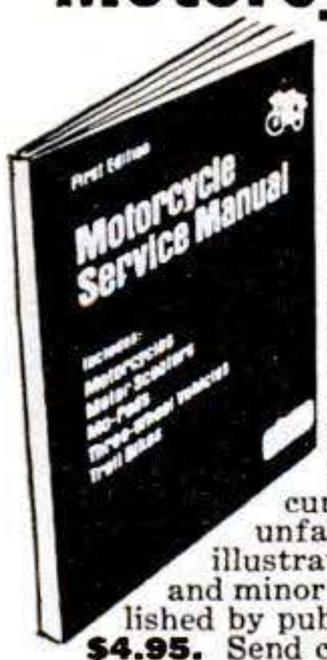

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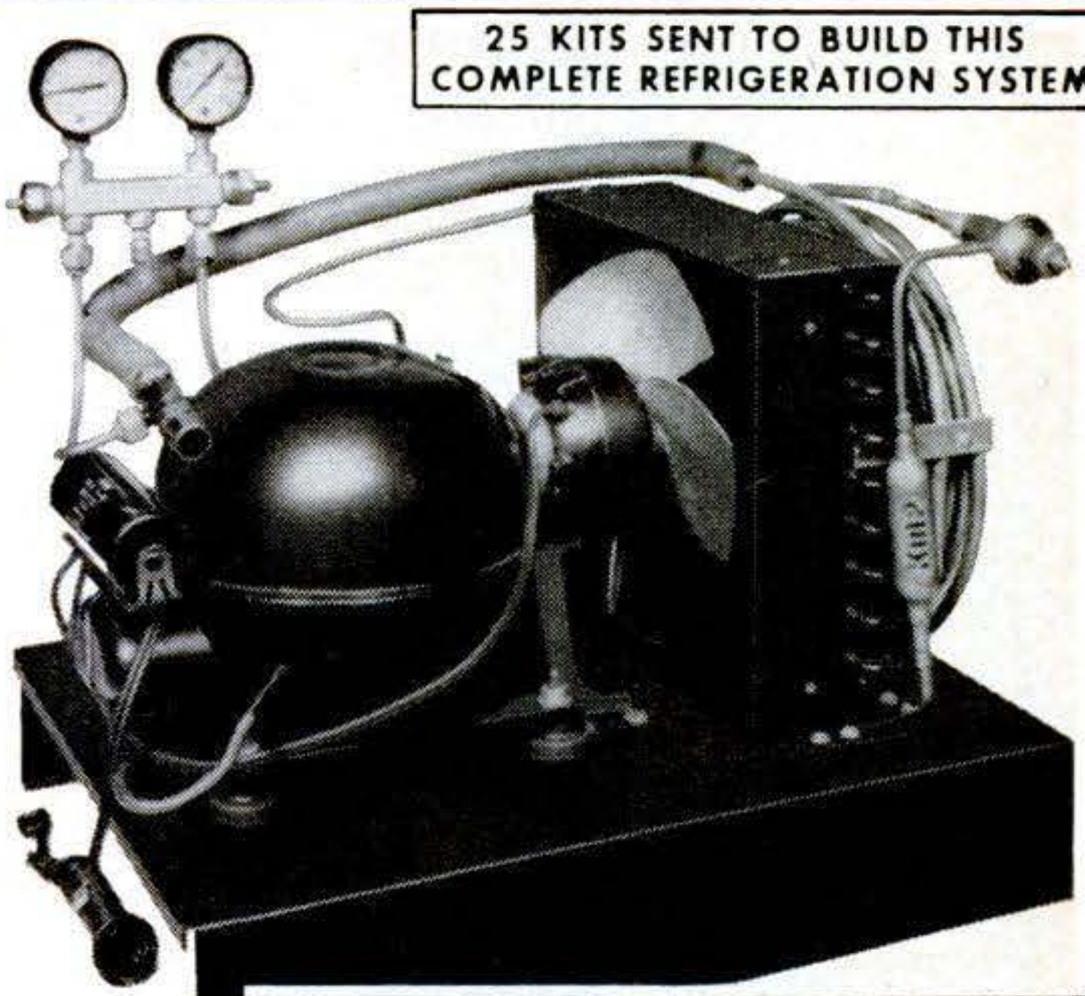

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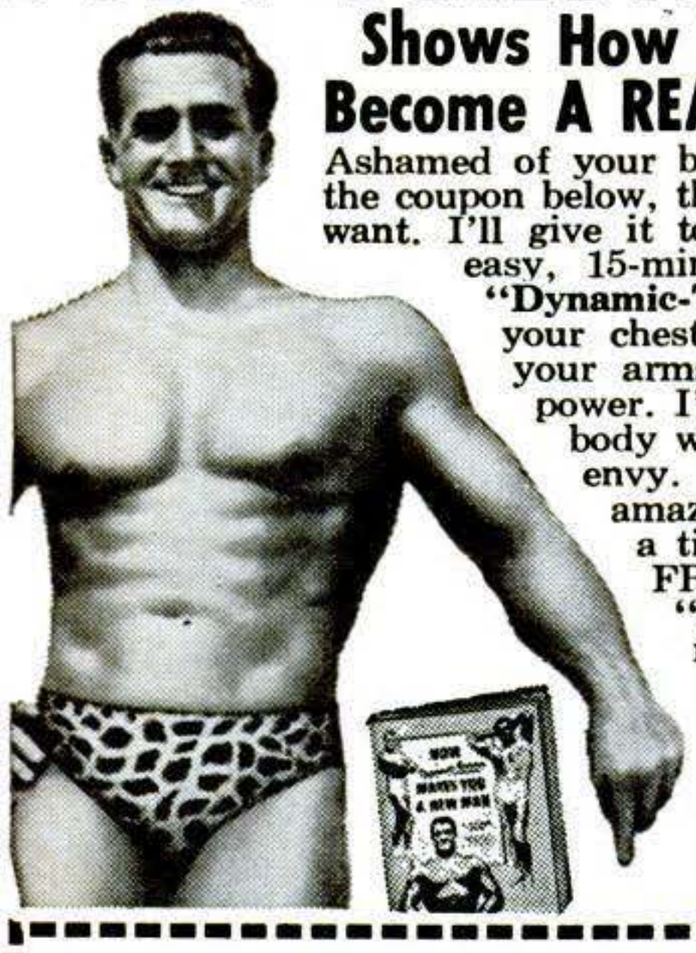

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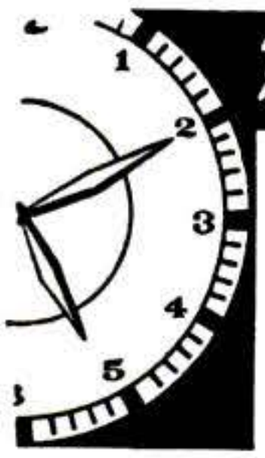

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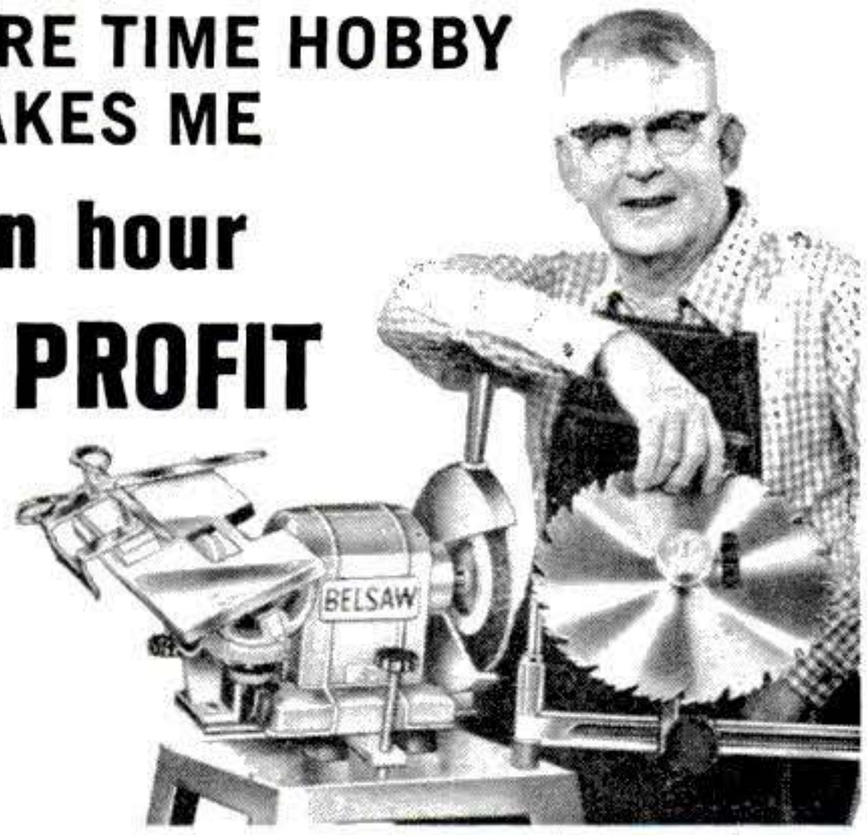

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Science Newsfront

Last-minute news and notes to keep you up-to-date

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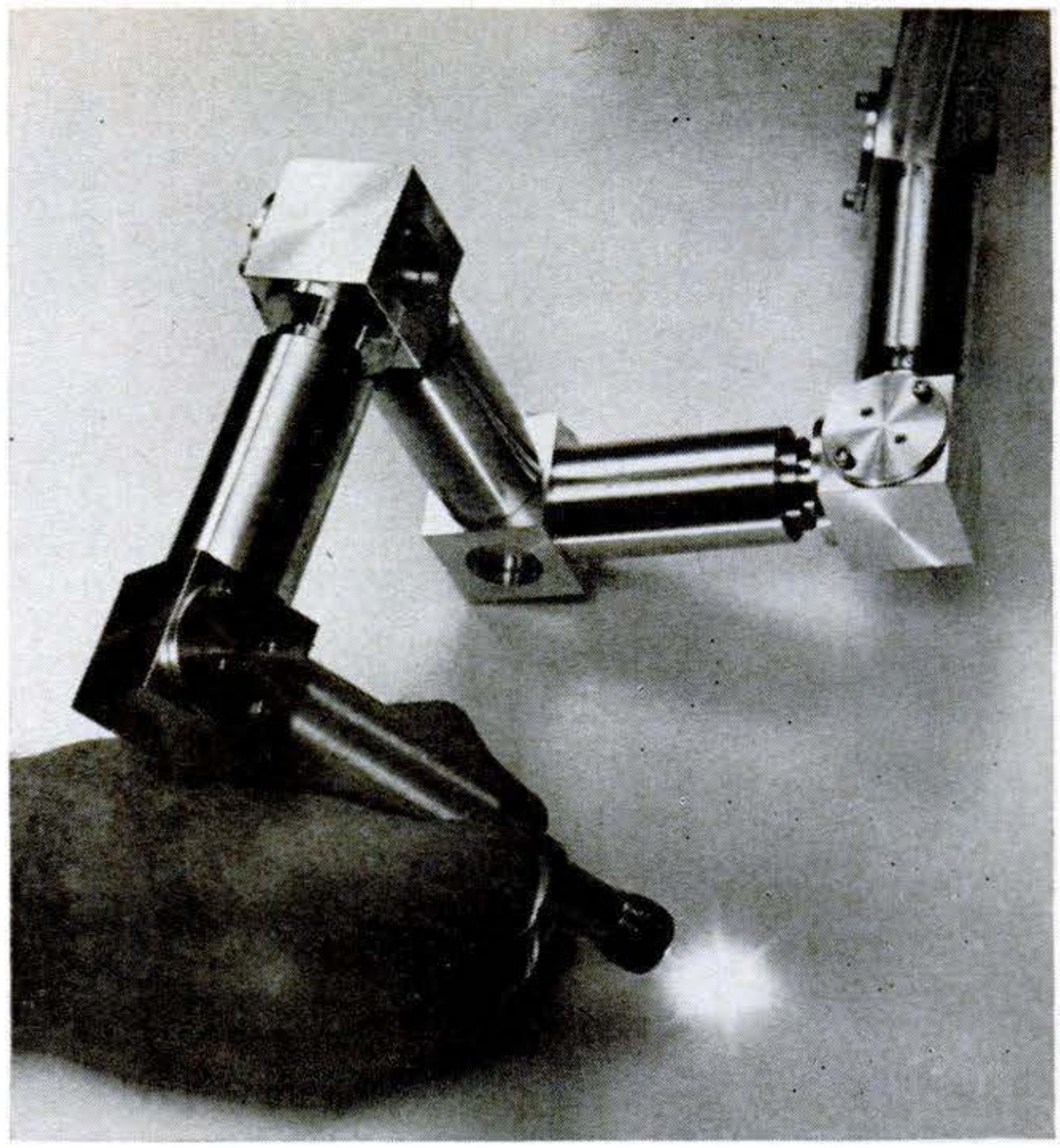

Laser "knife": a precision tool

Six hollow tubes and blocks mounted within each other on ball bearings form an arm with an elbow which guides a laser beam in delicate, precise surgery or in fine cutting of materials. Developed by Bell Telephone Labs to give surgeons scalpel-like control in laser surgery, the knife has prisms within each block to guide the laser beam around the 90-degree corners. Because the tubes swivel and the corners remain rigid, this 90-degree relationship is always maintained. The knife can be used with lasers of various types and powers for everything from eye surgery to delicate machine work. The probe is about the size of a fountain pen and contains a lens to focus the light a few inches away from the work.

Gasoline-electric cars

Hybrid cars powered by electric motors with the electricity generated by a gasoline engine might be the answer to the air-pollution problem until all-electric cars come along. According to Dr. George A. Hoffman of the University of California, such vehicles could match current cars in size and performance while cutting exhaust pollution 75 to 85 percent. The hybrids would use considerably less fuel than comparable gasoline-only vehicles. An experimental Army truck based on the hybrid principle is currently undergoing test [see "Now They've Put Motors Inside Every Wheel," PS, Aug., '66].

World's first magnetic-heat engine

An engine that uses magnets and a Bunsen burner to convert heat to motion (up to 110 r.p.m.) and has a theoretical efficiency of 34 percent has been demonstrated by M. P. George of the Birla Institute of Technology and Science, Pilani, India. At a certain temperature (the Curie point) permanent magnets show greatly reduced magnetism and magnetic permeability. Small permanent magnets are mounted on the circumference of an aluminum wheel that rotates between the poles of a large stationary magnet. The smaller magnets pull the wheel around to align themselves with the larger—at which point heat breaks the attraction and permits continuous rotary motion.

Tiny TV antenna would be built into set

A tiny transistorized built-in TV antenna that would be two or three inches long and give better reception than you now get from your roof antenna is likely to result from current Air Force research. What's more, it could be made to perform the tuning function over the VHF-UHF range, eliminating the need for a tuner and making TV sets less expensive. Called a "subminiature integrated antenna," the signal-amplifying device is the invention of Edwin M. Turner of the Air Force Avionics Laboratory, Wright Patterson Air Force Base, Dayton, Ohio. Originally intended to shave hundreds of pounds from aircraft and space vehicles, the antenna, in simplest form, consists of a T-shaped element connected to one element of a transistor. The remaining two transistor connections feed the TV set.

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But, of course, big companies spend more on research and development than little companies, too. And that's even more unfair because it helps develop new products the little companies don't have. So, perhaps, we should also restrict research and development.

It's too bad somebody didn't think of this 40 years ago. Then we'd all still have iceboxes. And you wouldn't have to worry about getting all that frozen food home from the supermarket before it thaws. In your 1967 Model "T."

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Pontiac Chevrolet Cadillac Rambler Dodge
Thunderbird Chrysler Ford Oldsmobile Dart Falcon

Let the Experts Who Make the Cars Show You How to

FIX 'EM FAST

with MOTOR'S great

2-in-1 AUTO REPAIR MANUAL

1. Famous Illustrated Manual shows how you can fix just about any part of 2,300 CAR MODELS 1959-1967 including all new Cars — Quick, Easy, Right!
2. TROUBLE-SHOOTER Section spots 2,300 Car Troubles for you immediately .... leads you to exact Repair needed!

Now "breeze thru" tough car repair jobs! MOTOR's brand-new 2-in-1 Manual brings you expert guidance from the engineers who *make* the cars. 1,256 big pages, 3,800 pictures, crystal-clear directions *make every job easy as A-B-C.* FREE 10-DAY TRIAL. Then pay $2 in 10 days, $3 a month for 2 months, then $1.95 (plus delivery charge and sales tax), or return book postpaid. *Send no money now!* Cut out this ad — mail with name and address to MOTOR BOOK DEPT., Desk 250 West 55th St., N. Y., N. Y. 10019.

Print Name.....Age.....
Address.....
City & State.....Zip Code.....

CEILING TILE?

Install it faster, easier and better . . . with ARROW'S T-50 HEAVY DUTY STAPLE GUN

THE GUN FOR 1001 FASTENING JOBS

- Install ceiling tile
- Install insulation
- Weatherstrip doors and windows
- Reupholster furniture
- Staple wire fencing to posts
- Repair window and door screens
- Fix loose wiring to floors, walls
- Replace worn window shades
- Tack down carpets
- Lay new linoleum
- Attach vines to trellis
- Affix plywood panels to walls
- Wrap and staple young tree trunks
- Line kitchen and closet shelves
- Hang drapes and curtains
- Make decorative cornices
- Cover valences with material
- Put up Christmas decorations
- Staple down building felt
- Quickly repair odd woodworking jobs

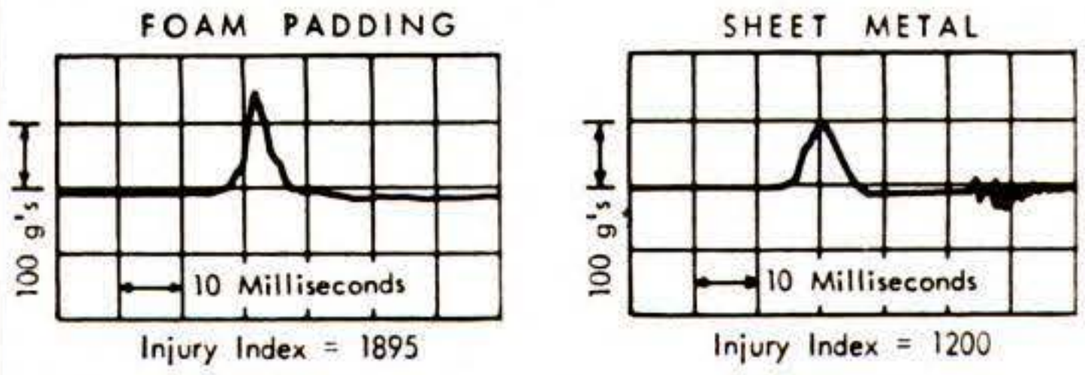
USE THIS AS A HANDY CHECK LIST

ARROW FASTENER COMPANY, INC.
Saddle Brook, New Jersey 07663

Science Newsfront
[*Continued*]

Sheet-metal cushions for cars?

Strangely enough, hollow sheet-metal cushions would probably do more to protect your head from injury in an accident than foam padding. (Note graphs: The force of deceleration on a model head rises substantially over 100 *g* for foam padding during the 10-millisecond impact period. The injury index, based on force versus probable injury, is, therefore, much greater.) This finding is one of several recently presented by GM at a University of Michigan symposium. Another point: A dashboard that is close to the driver might be better than one that is recessed to reduce the driver's impact velocity in an accident he'd "ride down" with the deceleration of the car.



Typing with compressed air

One of the first really practical uses for fluid amplifiers [see "Fluidics: How They've Taught a Stream of Air to Think," PS, June] promises to be a new compressed-air typewriter invented by Arnold Schonfeld of Sperry Rand's Univac Division. The typist's fingers close air jets in the stationary keys, and fluid amplifiers controlling larger jets of air then push the type against ribbon and paper. Although there have been many compressed-air typewriters, most have not been able to keep up with a fast typist. The new machine should operate at speeds up to 720 words per minute.

Single-pedal brake-accelerator

You might be able to stop your car in time to avoid an accident if it were equipped with a combination brake-accelerator now being tested by Dr. Stephan Konz of Kansas State University. Based on a treadle design with a rim at the bottom to hold your foot, the new control feeds gas to the engine when the toe is pressed, but starts braking action when you rock it back with your heel. According to Konz, drivers learn the system quickly and save an average of .15 second over conventional braking. Unlike similar devices using fine toe movements only [see "Out Goes the Brake Pedal," PS, Sept., '55], it requires deliberate heel-toe action.

Radar spots shoplifters

Carrying items out of a store without pay-

Continued

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INVEST *NOW!*
PROSPERITY AWAITS YOU!

1 1/4 ACRES

MEADOW VALLEY *RANCHOS* in NEVADA

$1.00 DOWN

$10.00 MONTHLY

FULL PRICE $595.00

THE BOOM THAT HAD TO COME IS NOW ON IN NEVADA. Ground floor buyers have reaped fortunes from small initial investments. A factual example of skyrocketing values is Las Vegas, Nevada. Land that originally sold for $200.00 an acre, now sells for $20,000.00 an acre, a profit of 1000%! The first offering of LAS VEGAS land was open to everyone. Buyers who took advantage of low opening prices have become wealthy. The ground floor opportunity of Las Vegas is gone, BUT ANOTHER AREA OF PROSPEROUS NEVADA IS BEING RELEASED FOR PUBLIC SALE!

This area has such a tremendous growth potential, such a fantastic, unlimited future, that wise investors have purchased large acreage. Bing Crosby's ranch was one of the largest cattle ranches in the county. James Stewart is honorary sheriff. Yes, the smart, experienced investors have sensed the future and are buying MEADOW VALLEY RANCHOS in Elko County, Nevada.

MEADOW VALLEY RANCHOS has all the factors needed to boom . . . to prosper . . . to skyrocket its land values. Ideally located in the prospering Elko Valley, The Ranchos have the backdrop of the statuesque Ruby Mountains. The sparkling Humboldt River actually flows through the property and is a valuable asset of the Ranchos. Every Rancho fronts on a graded road. The City of Elko, with its long established schools, churches, and medical facilities is MEADOW VALLEY RANCHOS friendly neighbor.

FAMILY RECREATION

FISHING: A fisherman's paradise. Huge Rainbow, Brook Trout and German Browns abound in Alpine-like lakes and mountain-fed bottom streams.

GOLF: Enjoy leisurely golfing, with never a rush for starting times, at the city owned Ruby View Golf Course. This beautiful golf course is only minutes from the property.

LAKE OSINO: No charge to Rancho owners for full privileges at nearby Lake Osino. Fish, Picnic and Relax with your fellow Ranch owners at this private lake and recreation area.

HUNTING: You will find the hunting of your life. Big game species such as Mule Deer are abundant. Duck, Quail and Chukar are plentiful.

YOUR PROFITABLE TOMORROW —

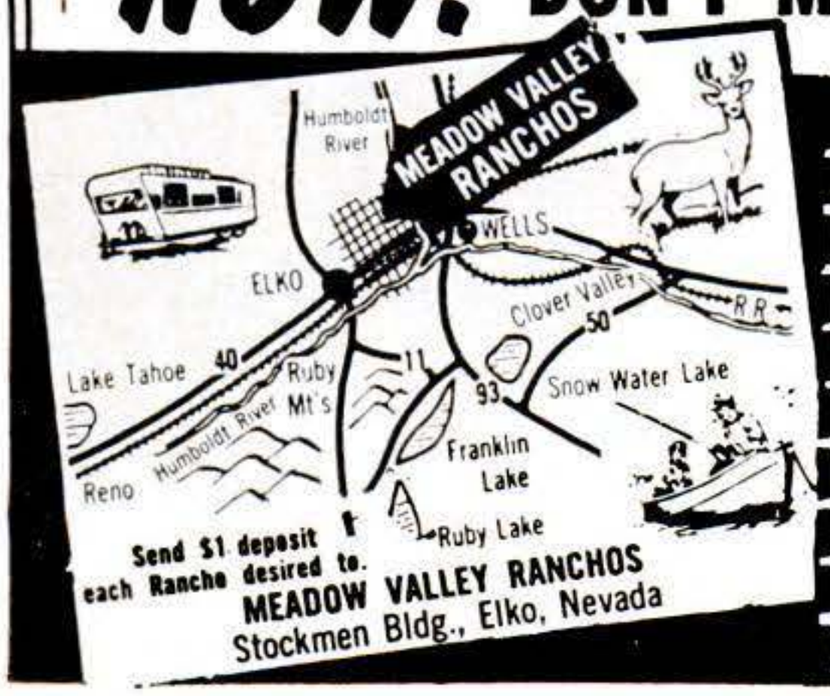
YES, wise investors are buying in MEADOW VALLEY RANCHOS, but America's largest corporations, whose research closely follows the trend of increasing land values and population growth, are also busy investing throughout Nevada. U.S. COMMERCE BUREAU FACT: Per capita income in Nevada is highest of all 50 states.

TAX RELIEF — No State Income, Gift or Inheritance Tax. The low Real Estate Property Tax is actually limited by the State Constitution.

WHAT ARE THE TOTAL COSTS?

The full price of the title to your 1¼ acre Rancho is only $595. Total payment schedule is $1 down, and $10 per month. No interest, no carrying charges. John D. Rockefeller said, "The big fortunes of the future will be made in Real Estate." You are not required to do anything to your land. You can live or vacation on it, or simply watch its value grow, then sell all or part of it for a profit. Your profitable tomorrow is here today in MEADOW VALLEY RANCHOS.

NOW! DON'T MISS THIS OUTSTANDING OPPORTUNITY!



MEADOW VALLEY RANCHOS

4405 STOCKMEN BLDG., ELKO, NEVADA 89801

MAIL COUPON TODAY

Yes!—Reserve acreage at MEADOW VALLEY RANCHOS for me—$595 for each 1¼ acre parcel—payable $1 down and $10 a month. No other charges. Send purchase contract and map showing exact location of my holding. You will return my $1 deposit if I request same within 30 days. I enclose $1 deposit for each 1¼ acre Rancho desired.

SIZE ACRES	DOWN	PER MO.
1¼	$1	$10
2½	2	15
3¾	3	20
5	4	25

Name:_____

Address_____

City:_____ Zone:_____ State:_____

Indicate No. of Ranchos_____ Total enclosed $_____

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You Can Learn To Be A LOCKSMITH in your spare time

There's a big demand for skilled locksmiths. You can earn big money either full or part-time in your own home. Be your own boss; earn steady, year 'round income with no layoffs. The BELSAW INSTITUTE training, recommended by professional locksmiths, teaches you to make keys, open and repair locks on homes, cars and buildings. Easy, step-by-step illustrated lessons complete with all tools and supplies. We tell you how to get servicing jobs, how much to charge, how to earn while you learn and how to build a secure cash profit business. Approved for veterans.

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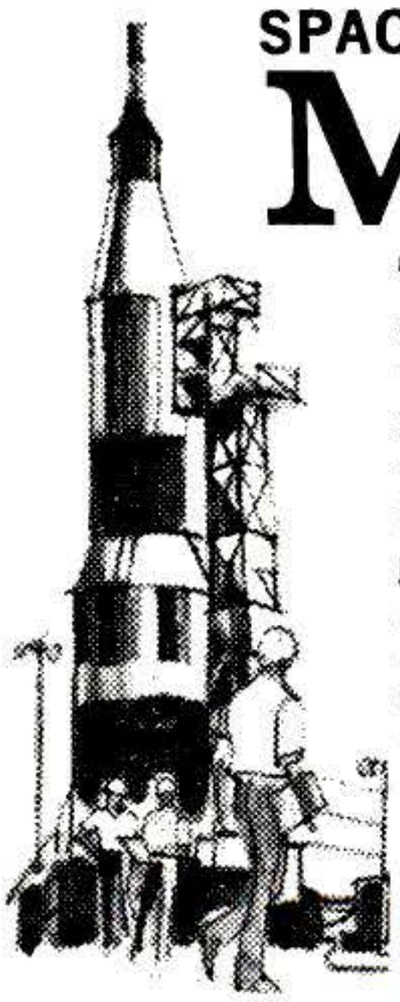

The Milwaukee School of Engineering offers residence study leading to Associate in Applied Science degrees in a wide range of Engineering Technologies and Bachelor of Science degrees in Electrical and Mechanical Engineering.

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MILWAUKEE SCHOOL OF ENGINEERING
Dept. PSM-767
1025 N. Milwaukee Street, Milwaukee, Wisconsin 53201

ing for them would automatically set off a radar alarm with a new system developed by JKR Corp. of Akron, Ohio. Secret is a sensitized metallic dot which can be concealed in merchandise or made a part of the price tag. Unless it is desensitized, the dot acts as a microwave reflector and sets off an alarm when the customer carries it—with attached goods—through microwave fields that guard store entrances. The reflecting properties of the dot are destroyed when the customer pays for the merchandise and it passes through an electrical field created by a unit under the check-out counter.

Phantom traffic signals ended

The glare of the rising or setting sun on traffic lights makes for hazardous driving—often, both red and green signals appear to be lighted. A new type of glass has been developed by Sendlinger Optische Glasswerke, West Berlin, to combat the problem: It absorbs light striking it from the outside so that the signal appears dark until it is illuminated from within.

Saving the Leaning Tower of Pisa

According to various estimates the famous Leaning Tower of Pisa will fall within 80 to 200 years if nothing is done to stop its tilting. In an unusual proposal, Cornell University engineer Melvin I. Esrig would pass electricity between hollow perforated iron electrodes driven into the soil on the side away from the tilt to draw the water out of the ground and let it compress. This technique—successful in straightening earthquake-damaged buildings in Mexico City—would reduce tilt and relieve pressure pushing the tower over. The Leaning Tower has been tilting since it was started in 1174; it's now 14 feet, 10 inches from perpendicular.

Rock 'n' roll: hard on ears

Rock 'n' roll haters have two new champions. They're Drs. Charles P. Lebo and John Garrett of the University of California who claim that "rock" causes temporary deafness and may even produce permanent ear damage. Visiting California night clubs they recorded sound levels of 90 to 105 decibels with peaks up to 120 (about the level of a jet engine). Some states require protection for workers exposed to 85 decibels or more. What's worse, the ear is especially sensitive to sounds between 500 and 3,000 Hz.—the range where electric guitars, "chords," and percussion instruments have the highest output. Garrett, listening without ear plugs, said he was unable to hear his watch tick for three hours after a session. PS

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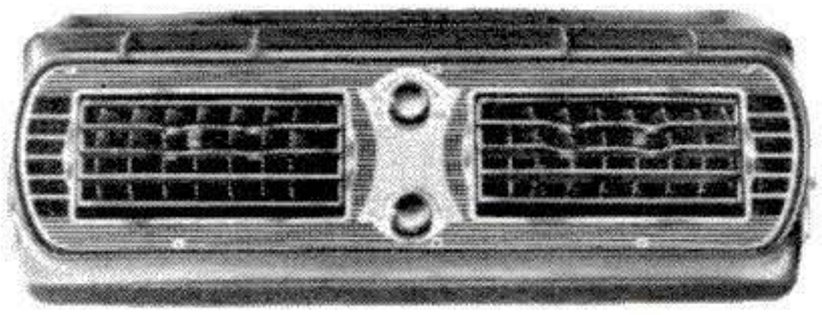
HERE'S WHAT SOME OF THE OVER 3,000 HAPPY PEOPLE WHO INSTALLED COMFY-KIT SAY ABOUT IT:

"Local service center could not believe the economy of my unit and the fact that my son (18 yrs.) and I had installed it in 6½ hrs."
W.T.M.
Hagerstown, Ind.

"In less than four hours I was able to install my Comfy-Kit. The savings were between $75 and $100. Dividing by four hours is pretty good income per hour."
C.A.J.
Omaha, Neb.

"The Comfy-Kit worked fine even in 100° heat. The travelling was a pleasure and we had a wonderful honeymoon."
P.G.
Brookline, Mass.

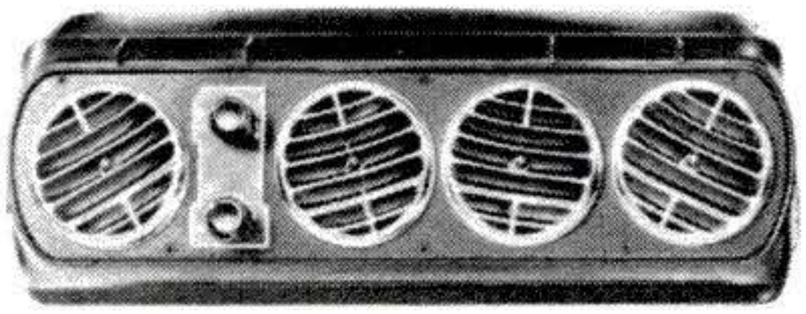
THE COMFY-KIT SUPER-AIR



ONLY $153*

save $75 with the Comfy-Kit Super-Air. Install-it-yourself. Complete kit and easy to follow instruction manual – plus tools if you need them – just a couple of evenings or a Saturday morning and you can air condition your present car. Can be transferred from car to car.

THE ORIGINAL COMFY-KIT



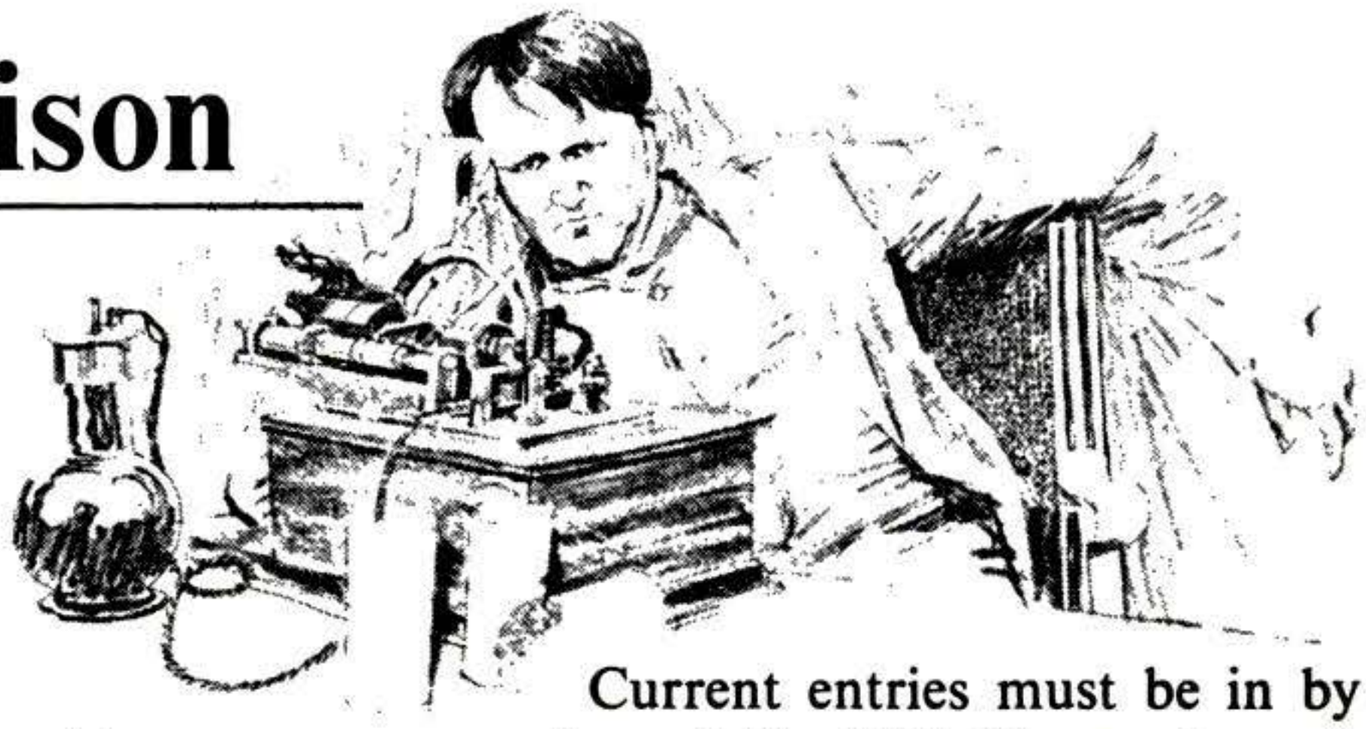
ONLY $143*

save $85 with the Original Comfy-Kit. Fits all standard U.S. cars. You don't have to be a mechanic to install Comfy-Kits. When ordering Comfy-Kits please state unit model wanted, size of engine, make, model and year of car. Order yours now – enjoy cool comfort this summer. Comfy-Kit is backed by a 12 month, 12,000 mile warranty.

COMFY-KIT® P.O. Box 8585, Dallas, Texas 75216, Dept. PS

*NOTE: Special mounting brackets for 1966-67 Ford, GMC, and AMC cars with smog devices $15.00 extra.

Write about Edison



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$675.00 writing scholarship

If you suspect you can write, you may have talent that could bring you good money. Here's how to find out.

Thomas A. Edison was one of the great inventors of recent history. Write brief answers (no more than 100 words each) to these questions about Edison.

1. Of all Edison's inventions, which do you think is currently most important?

2. How would your life be different without that invention?

Send us your answers along with the coupon. If your entry is judged best, you will win a complete $675.00 writing course. You'll be taught by professional writers in one of America's leading home study writing schools. Every entrant will get a professional talent evaluation.

Current entries must be in by August 31, 1967. None returned. Amateurs only. Our students not eligible.

PALMER WRITERS SCHOOL
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Here is my entry for your current writing contest.
(PLEASE PRINT)

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Occupation_____ Age_____

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1. Training Means Money These Days

In today's job market, men with specialized training get the good jobs—and good pay. Trained men get the promotions and pay raises that count. In virtually every field, TRAINING spells the difference between staying where you are—and moving ahead.

Look over the list of fields below. In each, I. C. S. has been training men and women for years. Giving them up-to-date knowledge that will let them advance in their present job . . . or break into an entirely new field. I. C. S. can do the same for you—starting RIGHT NOW.

2. Jobs in Architecture, Building

ARCHITECTS—Qualify for advanced positions in architectural, engineering offices. I. C. S. courses begin with basics. Knowledge to help prepare for A.I.A. exams. Math. Drawing. Design. B'ld'ng, M'ch'n'c'l trades. Write "Architecture" on coupon for FREE booklets.

ARCH. DRAWING—One-course stepping-stone to architecture. Emphasis on drawing practice. No previous experience necessary. Apply now.

CARPENTRY—Largest demand area in building trades. $4.07 average hourly wage. Over 20,000 openings yearly. Training needed. Send coupon NOW.

PLUMBING-HEATING—Earn $4.30 hourly—average for plumbing-heating specialists. I. C. S. course has proven track record. Starts with basics. Mail coupon for FREE Success Kit.

3. Art Talent Sought

COMMERCIAL ARTISTS—Experienced artists earn $150 and more weekly. But training is essential. Course starts with fundamentals. Job-related. Personalized instruction. Break into field full- or part-time. Write "Commercial Art" on coupon.

INTERIOR DECORATING—Non-technical course for homemaker, home furnishings salesperson. Study carpets, furniture, walls, windows, decor, color, taste. Mail coupon now.

SIGN PAINTING—Course prepares you to break into field. Covers all aspects: layout, design, painting, gilding, screen process. Send coupon for 3 FREE booklets.

SKETCHING & PAINTING—Like to draw? Feel you have talent? Get training. For spare-time enjoyment, or use in present line of work. Course starts with basics, covers popular art mediums.

4. Automotive Specialists

AUTO ELECT. TECHNICIAN—More electrical equip. on cars—more need for elect. specialists. I. C. S. course covers the circuits, headlamp to taillights. Simply written, illustrated texts. Send coupon for 3 FREE booklets.

MECHANIC (GEN'L)—700,000 employed. 20,000 openings yearly, and employment on the upswing. Famous I. C. S. course taken by thousands in field. Coupon brings Success Kit.

TRANSMISSION SPEC'L'ST—If you now know cars, why not become a specialist? Course covers transmission troubles, testing, repairing, overhauling. Auto., standard.

5. Businessmen Make $$$$$

ACCOUNTANTS—20,000 openings a year in this high-pay field. I. C. S. courses cover the basics plus 10 vital accounting specialties. Get information. Send coupon right NOW.

ADMINISTRATION—The key to business success. Famous I. C. S. course covers 3 vital areas: management, production, marketing. Write "Business Administration" on coupon.

EXEC. TRAINING—A company's as good as its top people. Learn to train men, to spot "comers." Mail the coupon.

MARKETING MEN—Advance to management? You'll need marketing knowledge. Course covers management practices, principles, with emphasis on marketing. Get started now.

PROGRAMMERS for digital computers. Space-age specialty. Earn up to $15,000 yearly. Specialized—training vital. This course gives it.

PURCHASING—Advance to purchasing agent? Break into field? Take this course. Demand for PA's rising. Experienced men earn average salaries of $8-$15,000. Send for Success Kit.

SALESMANSHIP—I. C. S. is famous for this course. Covers basics of selling that stay same, no matter the field. 1,000,000 new salesmen needed 1965-75. Get started NOW. Write "Salesmanship" on coupon.

YOU CAN GET A BETTER JOB

by spare-time study with I. C. S.

SMALL BUSINESS MGT.—Run your own business. Course tells how. Covers purchasing, merchandising, sales, taxes, accounting, etc.—all you need to know.

TRAFFIC MGT.—Employment forecasts show upward trend for trained traffic people. Course covers entire traffic picture. Prepares you to enter or advance in field. Send coupon today.

6. Chemistry

CHEM. ENGINEERS—Youngest engineering field, expanding with industrial development. Course prepares you for registration exams. Also for breaking into chemical design, development or production departments. Send coupon for Success Kit. It tells whole story.

GEN'L CHEM.—A good course in gen'l chemistry? What easier way than at home, in spare time. Also covers basic math, physics.

NUCLEAR ENERGY—Course for engineers, technicians, maintenance men who want to enter nuclear field. Covers basic math, physics & chemistry leading to study of radioactivity and nuclear energy.

PLASTICS—Qualify as plastics technician. Take this course. Texts easy to read, written by experts. Mail the coupon for 3 FREE booklets.

PULP, PAPER SPECIALISTS—Courses cover engineering to paper machine operator. Demand field, exp'ct'd to increase 75% in next 25 years. Write for information.

7. How to Become a Civil Engineer

CIVIL ENGINEER—Famous course recognized by many states, prepares you to take exams. All aspects of civil engineering. Thousands of graduates. Write now for 3 FREE booklets.

HIGHWAY ENGINEER—Advance in field. Course complete, covers theory, practice. Recognized by many states. Send coupon now.

STRUCTURAL BLUEPRINTS—How to read them. A key to advancement for ironworkers, patternmakers, builders of concrete structures. Mail coupon now.

SANITARY ENG'N'R'NG—Men trained in this field in constant demand. Course covers water treatment-supply, sewerage, eradicating menaces to health. Apply now.

SURVEYING, MAPPING—Course for man who wants to enter civil engineering field, but undecided about branch. Texts illustrated, simply written. Personalized instruction. Mail coupon.

8. Draftsmen in Demand

DRAFTSMEN—Over 4000 openings yearly. Senior draftsmen earn average $550/month. Break into field? I. C. S. training in specialized area can help you. Don't delay. Choose field, then clip coupon.

ARCHITECTURAL drafting course covers arch. drawing, house planning, freehand & ornamental drawing, shades & shadows.

ELECTRICAL—Arithmetic, electricity basics, projection drawing, machine sketching, electrical drafting, other subjects.

ELECTRONIC—Math, mechanical drawing, formulas, electricity, electronic & printed circuit drafting, others.

MECHANICAL DRAFTING—Arithmetic, algebra, geometry & trig, projection drawing, mechanical drawing, machine sketching, others.

9. Electronics, Electricity

APPLIANCE SERVICING—More appliances mean more demand for servicemen. I. C. S. gives you know-how worth money from start. Clip coupon for Success Kit.

ELECTRICAL ENGINEERS—Demand field. Jobs in gov't, industry. I. C. S. training helps worker in field advance to junior, sr. eng'n'r'ng positions. Also helpful in preparing for registration exam. Starts with basics, if you have limited knowledge. Send coupon for 3 FREE booklets.

ELECTRIC MOTOR REPAIRMAN—Course starts with basics, covers AC, DC motors—perfect for would-be maintenance men, or those who seek advancement to supervisor.

INSTRUMENT TECHNICIAN—Specialists in electrical measuring & control equip. will be scarce in late '60's. Take advantage! Course gives training, starting with gen'l principles. Send for Success Kit right away.

PRACTICAL ELECTRICIANS earn an average of $4.37 per hour. Get the know-how! Course covers building wiring, elect. equipm'nt. Helps prepare for licensing, journeyman exams.

INDUSTRIAL ELECTRONICS—Technical-level course—thorough grounding in electronics. Take first step to cracking this rapidly expanding field. Mail the coupon.

ELECTRONICS TECHNICIANS—With 5 yrs. exp., they average $6500—many earn more!

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Be a specialist in this booming field! Course prepares you. Theory—you learn it. Plus practical application. Mail coupon now.

10. Engineering—a Profession

Take your first step to becoming a registered, professional engineer, with the help of famous I. C. S. courses. There are two routes to eng'n'r'ng: college and 4 yrs' exp. in field; or high school and 8 yrs.' exp. Then, state registration exam. I. C. S. courses help you obtain work where you can gain necessary field experience; give you knowledge you need to pass exams. Instruction available in Civil, Chemical, Electrical, Mechanical Engineering. Texts authored by authorities, are illustrated and simply written for quick comprehension. Study now, in spare time, for future success or retirement career in engineering. Write "Professional Engineer" on coupon. Do it now.

11. Success, Pleasure Through Better English Writing

BUSINESS WRITING—Command the written word—a key to business success! Course covers composition, copywriting, editing, typography, report writing. Send coupon for FREE Success Kit.

FREE-LANCE WRITING—A career for anyone with talent for writing. Course treats techniques, forms and—how to sell articles. Step-by-step instruction. Send coupon.

SHORT STORY WRITING—An avocation that can lead to spare-time profit. Course covers English grammar, elements of a good story. Emphasis on actual writing. Get started now.

PRACTICAL ENGLISH—A bedrock study of basic English. To improve your speech, writing. As refresher in the basics. People judge you by your language. Send coupon today.

12. More Formal Education

FINISH HIGH SCHOOL—It's never too late. And H.S. completion means much greater earning power and job security. I. C. S. High School programs let you complete your schooling at home, in spare time, at your own pace. Variety of courses offered: Business, Secretarial, Vocational, General. Complete only work you need for I. C. S. High School diploma. Start doing it now—by filling out coupon and mailing it!

COLLEGE PREPARATORY high school course also available. Take credits you need for I. C. S. H. S. diploma that prepares you for college entrance exams. It's never too late to start—if you have the desire. How about now?

LEARN LANGUAGES—Special, low-cost courses. Instruction by records, text, the world-famous Berlitz way. Specify language you're interested in: French, Italian, German or Spanish.

13. $$$$$ in Mechanics, Shopwork

AIR CONDITIONING EXPERT—Experienced men make $125 a week, average, and demand is rising. If you have basic mechanical knowledge, take this course. Instruction in maintenance, too. Write "Air Conditioning" on coupon.

INDUSTRIAL ENGINEERING—Advance to higher position in operation/management of industrial plant: this course gives the knowledge you'll need. Also first step to becoming registered eng'n'r. Send coupon.

INSTRUMENTATION—Several thousand new jobs a year in this demand field. A basic course. Write for Success Kit.

MACHINE DESIGN—A technical field itself, this knowledge is vital to draftsmen, and a big plus for production men, shop workers.

MACHINE SHOP PRACTICE—A basic course, giving overall knowledge of shop oper't'ns. Emphasis on practical facts. Personalized instruction. A must for the man who wants to advance. First step? Mail coupon.

MECHANICAL ENGINEERING—Within your grasp a high-pay field where at least 2600 new jobs open yearly. Write for Success Kit.

SHOP PRINTS—And how to read them. An authoritative, factual study. Vital to men who want to advance in shop work. Mail coupon now.

REFRIGERATION SPECIALISTS—Enter this booming field and learn the hard way? There's no need. Training spurs advancement—it's never been truer! Fill out coupon for complete information.

TEXTILE TECHNICIAN—The job outlook is good—for trained men. Course designed to help you break into field—or advance to management. Write "Textile" on coupon.

TOOLMAKING—The average toolmaker earns $26 daily. For good reason: he knows a specialized skill. I. C. S. course equips machinists to crack this specialty, where over 4000 jobs open up annually.

SAFETY ENGINEERING—A comparatively new field, and men with formal training are scarce. Be one. Take I. C. S. course. Covers math, plant design, equipment placement, psychology, safety principles, practices. Apply now. Clip coupon.

WELDING—6000 openings yearly for welders, and pay in line with demand. I. C. S. offers several courses, from the basics to specialized areas. Write "Welding" on coupon for 3 FREE books.

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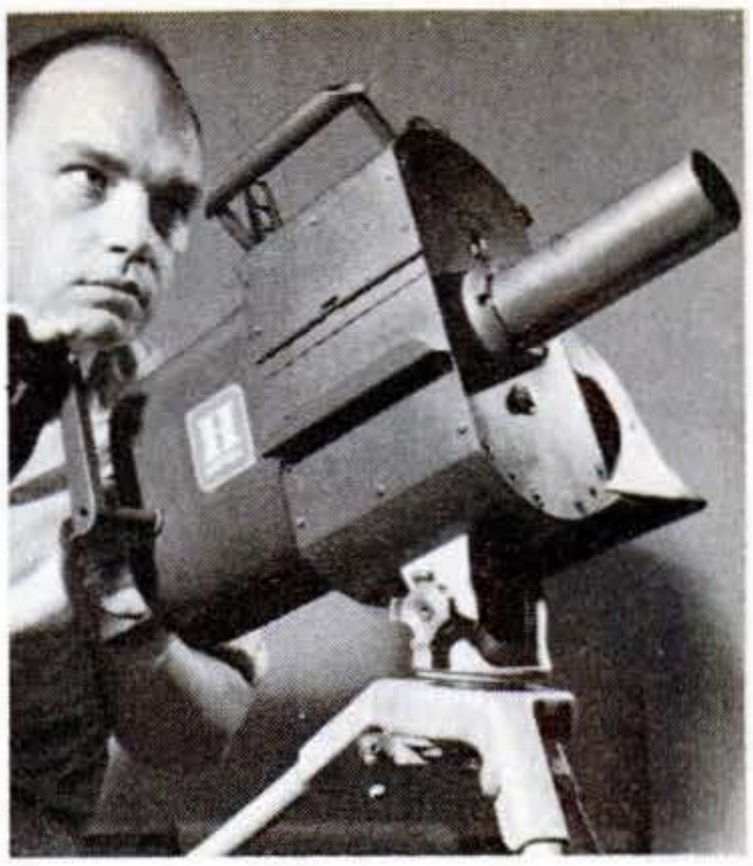
Two—count 'em—two V-8s power this car

Bob Reisner of Torrance, Calif., wasn't satisfied with one muscular V-8 in his hand-built aluminum-bodied car. He put in a second 400-cubic-inch Pontiac engine—plus two automatic transmissions and two rear ends. Speed: over 200 m.p.h. The car operates on both engines or on either one. Cost to build: $40,000.



Movies—1920 style?

The machine above and the two below seem to have something in common? You couldn't be wronger! This one is a hand-cranked grenade launcher—in an era of fully automated combat. It spews out belt-fed 40mm grenades at a 250-per-minute rate as the operator turns the crank. Designed by Honeywell's ordnance division, it weighs only 17 pounds.

Shoot the earth

These *are* cameras—to give TV audiences their first live view of earth from space. Made by RCA, they'll be mounted in NASA's second "advanced-technology satellite." The one at left has a 12mm lens with 45-degree field of view to shoot 76 million square miles of earth. The one at right has a 200mm three-degree lens to cover 100,000 square miles.

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Happy combo! Racy and rugged. Holy Toledo, what a car!

Leave ordinary, garden-variety driving behind...in this 'Jeepster' Convertible. The rugged rascal only Toledo could build—because that's where 'Jeep' ruggedness comes from.

Settle back in those bucket seats. Take the wheel. And *go!*

You'll be noticed...thanks to snazzy features like that continental spare. Now, hit the highway and open 'er up! What a smooth performer...specially if you choose that hot new V-6 with automatic transmission.

Then flip one lever...you're in 'Jeep' 4-wheel drive! You've got excitement ...and safety, too...you just won't find with ordinary sports cars. What's your idea of fun? This baby will get you there!

Or, maybe you'd rather choose from the 'Jeepster Commando' models. Roadster. Station wagon. And the sportiest pick-up ever!

The 'Jeepster' family. It's tough. Terrific! You've got to drive it to believe it! See your 'Jeep' dealer. Check the Yellow Pages.

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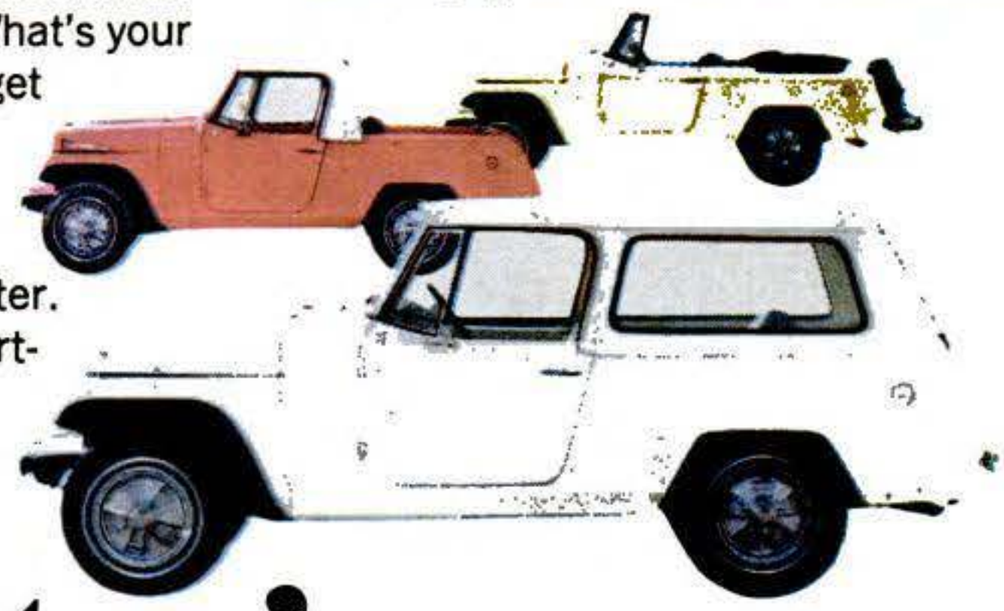

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Family of fun cars

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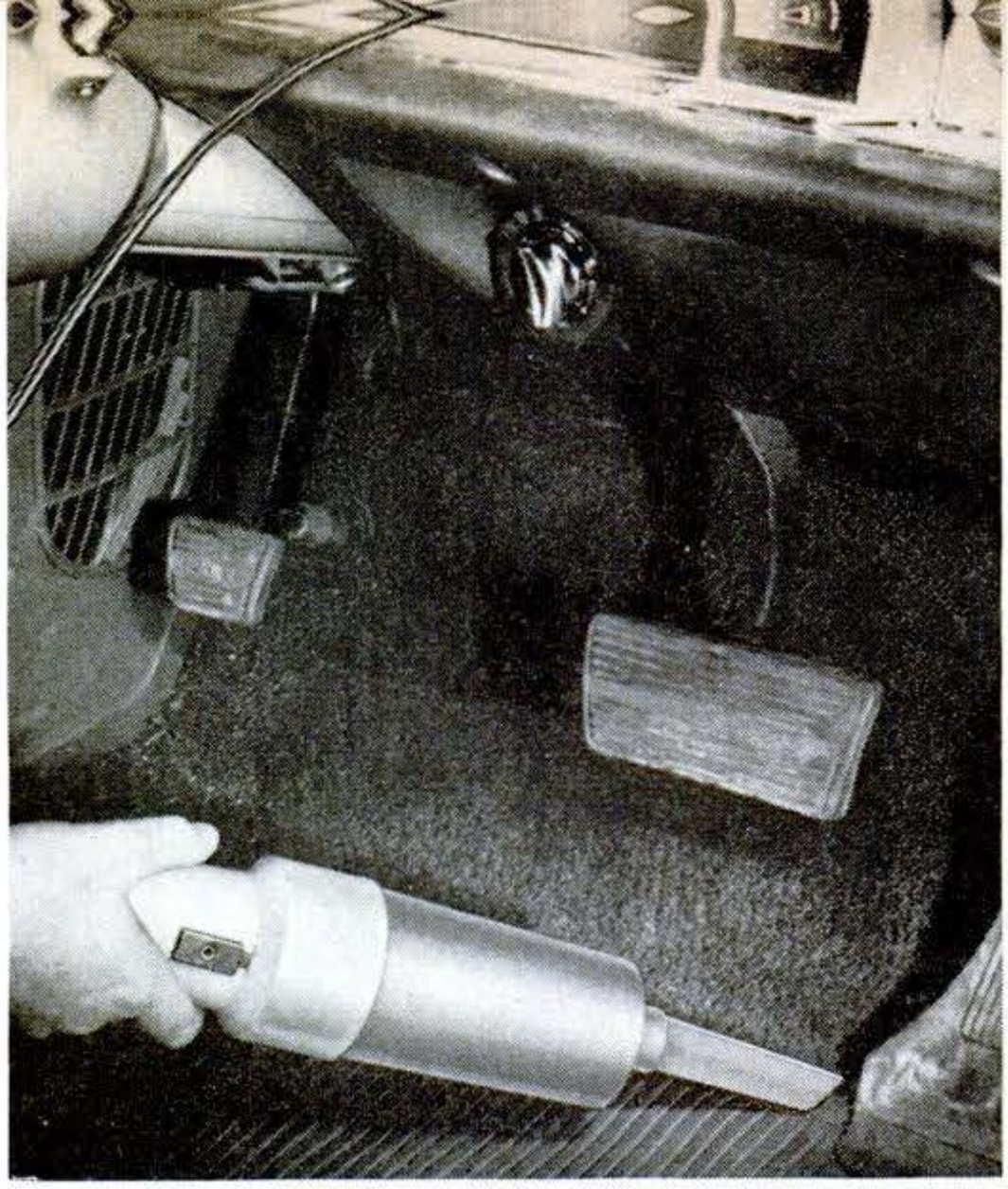


WHAT'S NEW

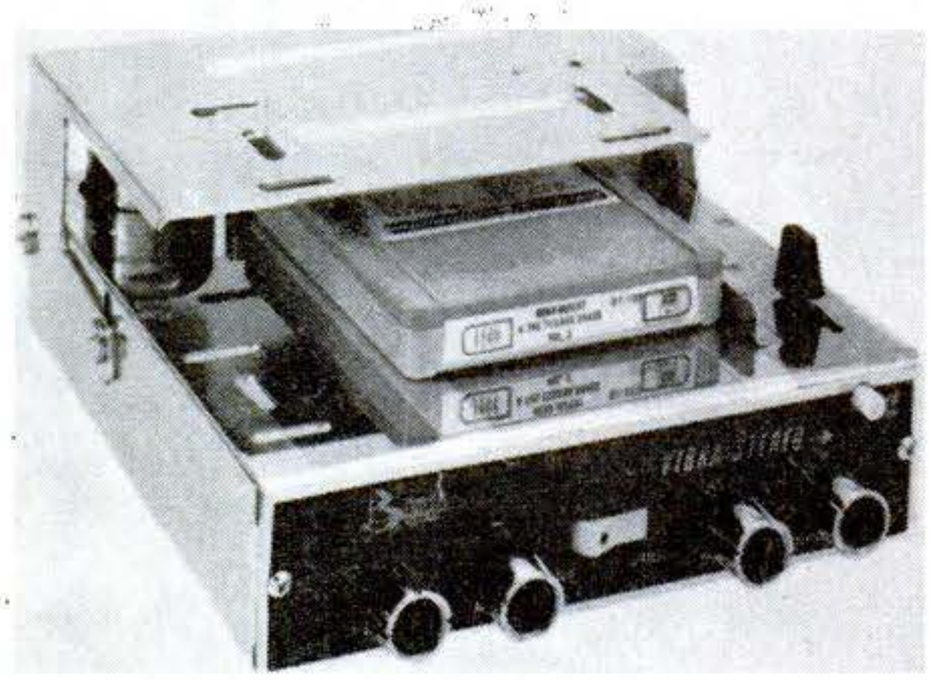
FOR YOUR CAR

Miniature car vacuum cleaner with super suction plugs into lighter socket

This small car vacuum combines the handiness of a portable with the power of a conventional household unit. The makers claim it pulls up pebbles, leaves, sand, and road dirt with ease. Two attachments make it possible to get at carpeting and upholstery, crevices, under-pedal areas, mats, and trunks. The Tornado comes with a 10-foot cord, works on 12-volt systems only. $7.95 from Osrow Products, Hazel St., Glen Cove, N. Y.

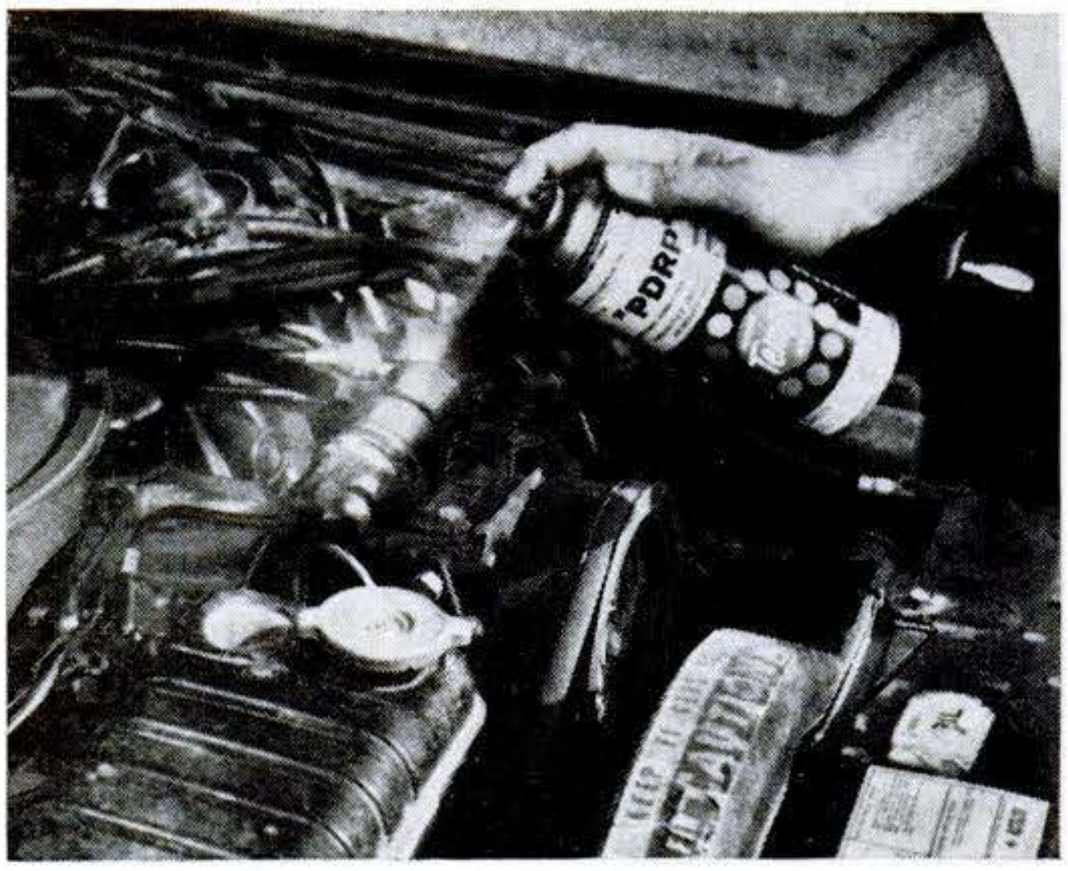
Rambler power-boost kit

American Motors 290-cu.-in. and 343-cu.-in. Typhoon V-8 engines can now be converted to high-performance power plants at moderate cost. This AM kit includes a high-lift camshaft, special hydraulic valve lifters, stiffer valve springs, and a special heat-blocker gasket for the intake manifold. The kit is designed to increase torque as well as horsepower and raise the useful r.p.m. range of the engines. Also available: a special 4.44:1 final drive ratio for acceleration.



Four-track vibra-stereo tape player

Flip a switch and this Bonan four-track tape-cartridge unit plays through your car radio. A button turns on a reverberator. $90. California Auto Radio, Downey, Calif.



Demoisturizer for quick starts in wet weather

This new material displaces and lifts moisture from engines and wiring by spreading itself under the moisture. PDRP is $1.95 a can. Tempo Products, Cleveland 44139.

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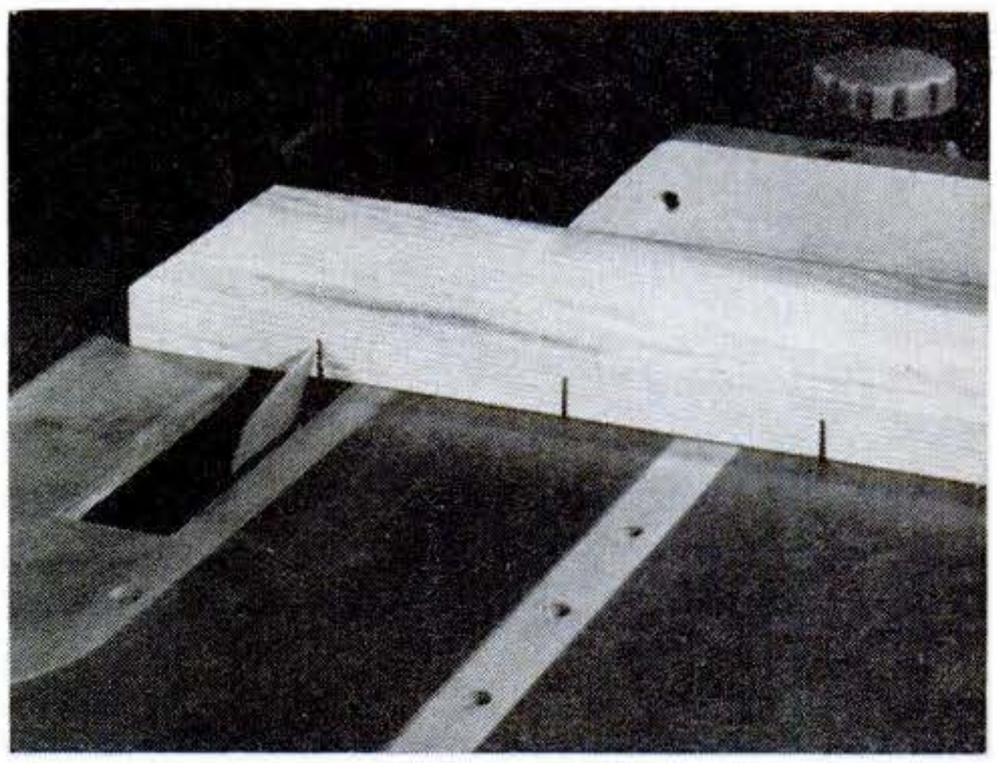


Chipper cuts narrow grooves

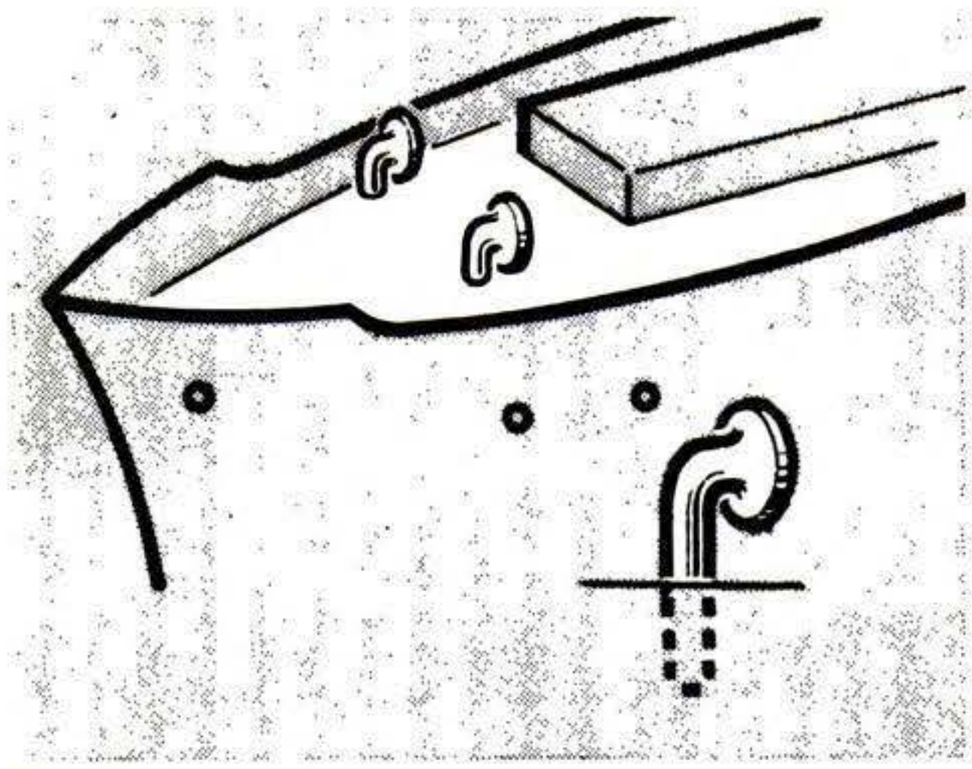
Chippers, normally used between the end blades of a dado assembly, can be used singly to cut narrow grooves difficult to make otherwise. Select a chipper of the desired thickness. But make the pass slowly so you avoid splintering and feathering.

F. J. De Cristoforo, Los Altos Hills, Calif.

Fireplace serves as spray booth

Your fireplace makes a fine spray booth for small objects. Make sure there are no live coals or embers and that the damper is open. Normal updraft will carry off fumes, and any spatter will burn off the next time you build a fire.

L. K. Davis, S. Easton, Mass.



Realistic ventilators for ship models

The flared, curved end of a bicycle spoke makes a very convincing ventilator scoop for small-scale ship models. Cut the end off and insert in the deck.

Harry Walton, White Plains, N. Y.

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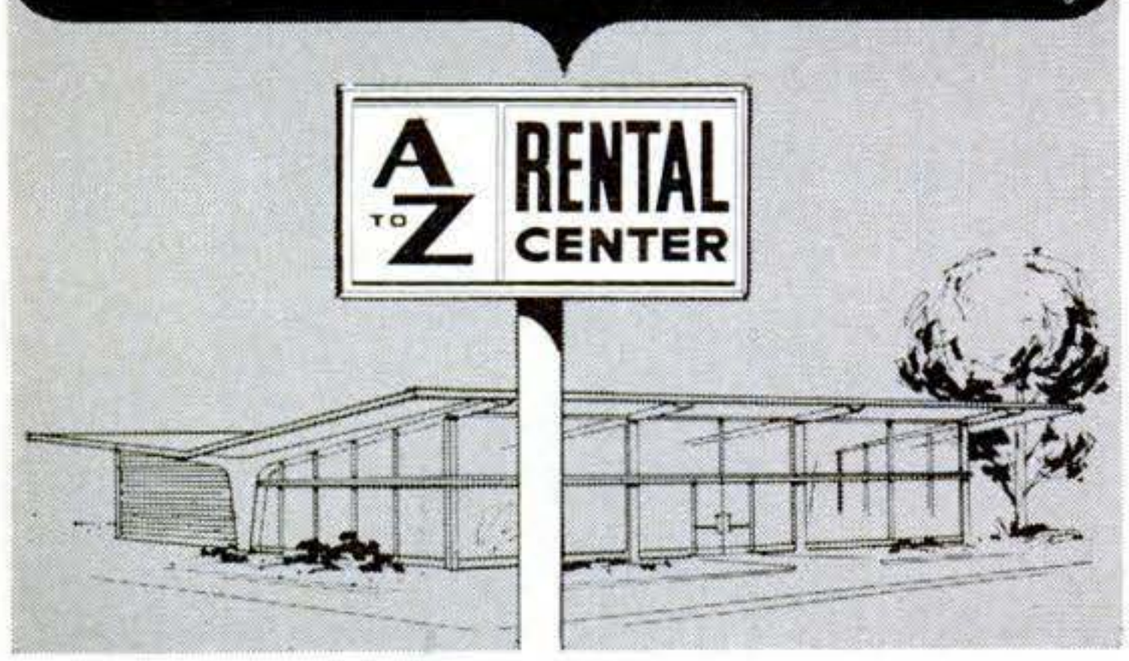

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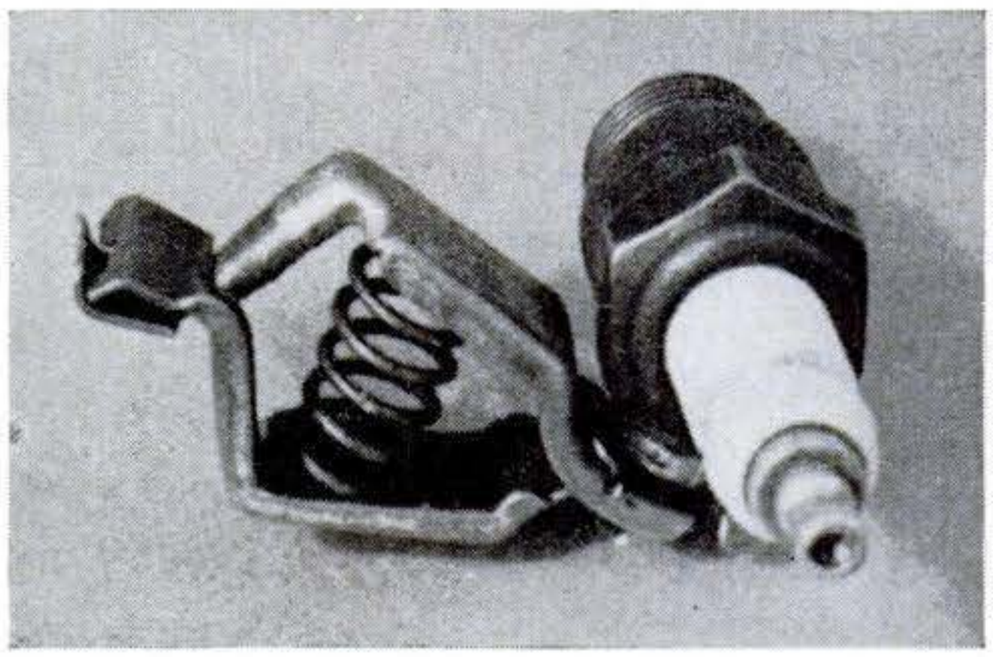
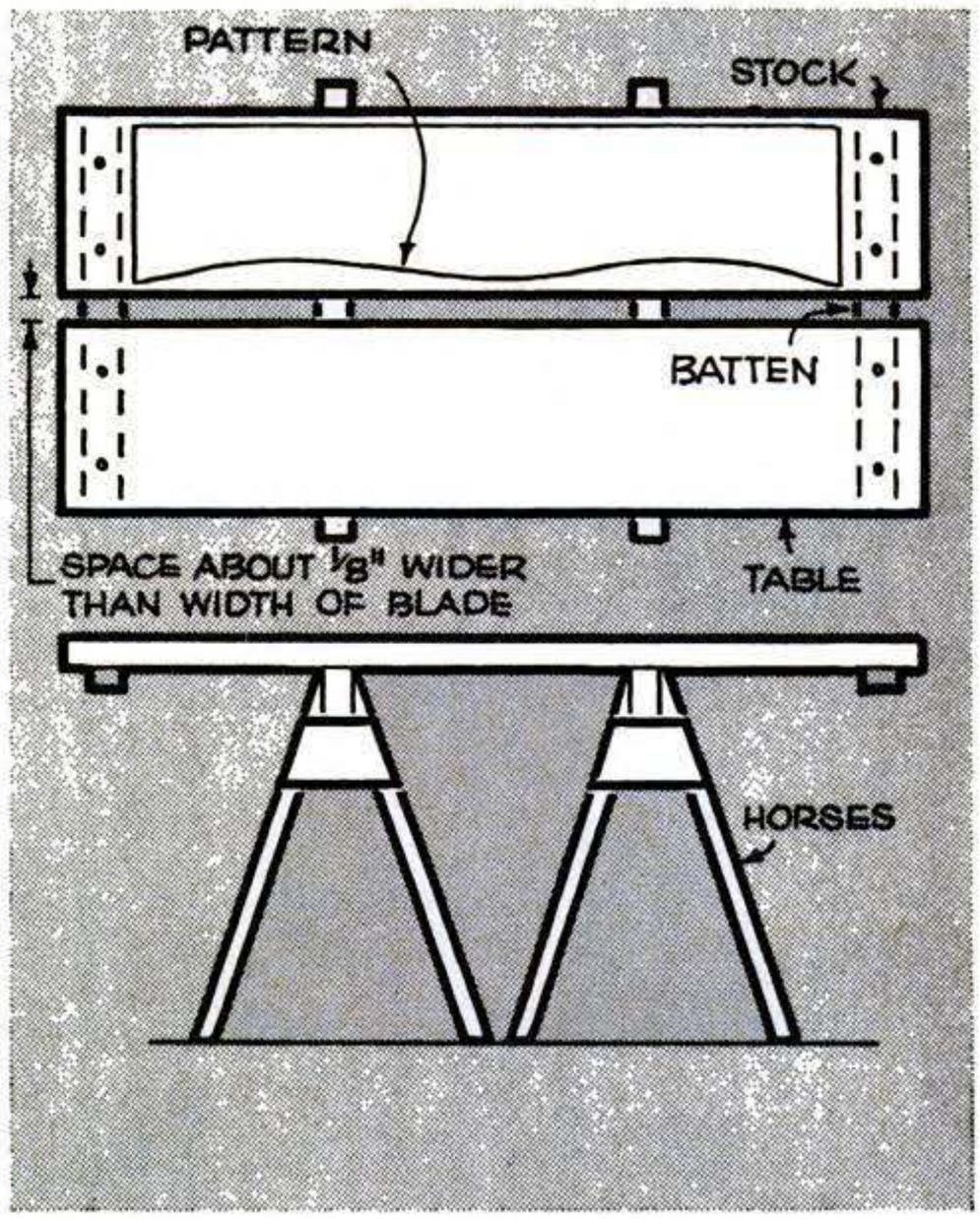


Ignition-testing small engines

Braze an alligator clip to a spark plug you know to be good, to test the ignition of small engines. On your power mower, for example, fasten the clip to the engine ground, take the ignition wire off the engine's plug and hook it to the plug on the clip. Cranking the engine will show you if the magneto is supplying a hot spark.

STANLEY CLARK, E. Bradenton, Fla.



"Table" supports saber saw

A saber saw is tiltproof for a true cut, if you support it like this when working close to the edge of stock. The work stock is temporarily fastened to a 4" board of the stock's thickness. If the pattern extends end to end, clamp the battens to the stock and table.

R. C. ROETGER, Warrington, Fla.

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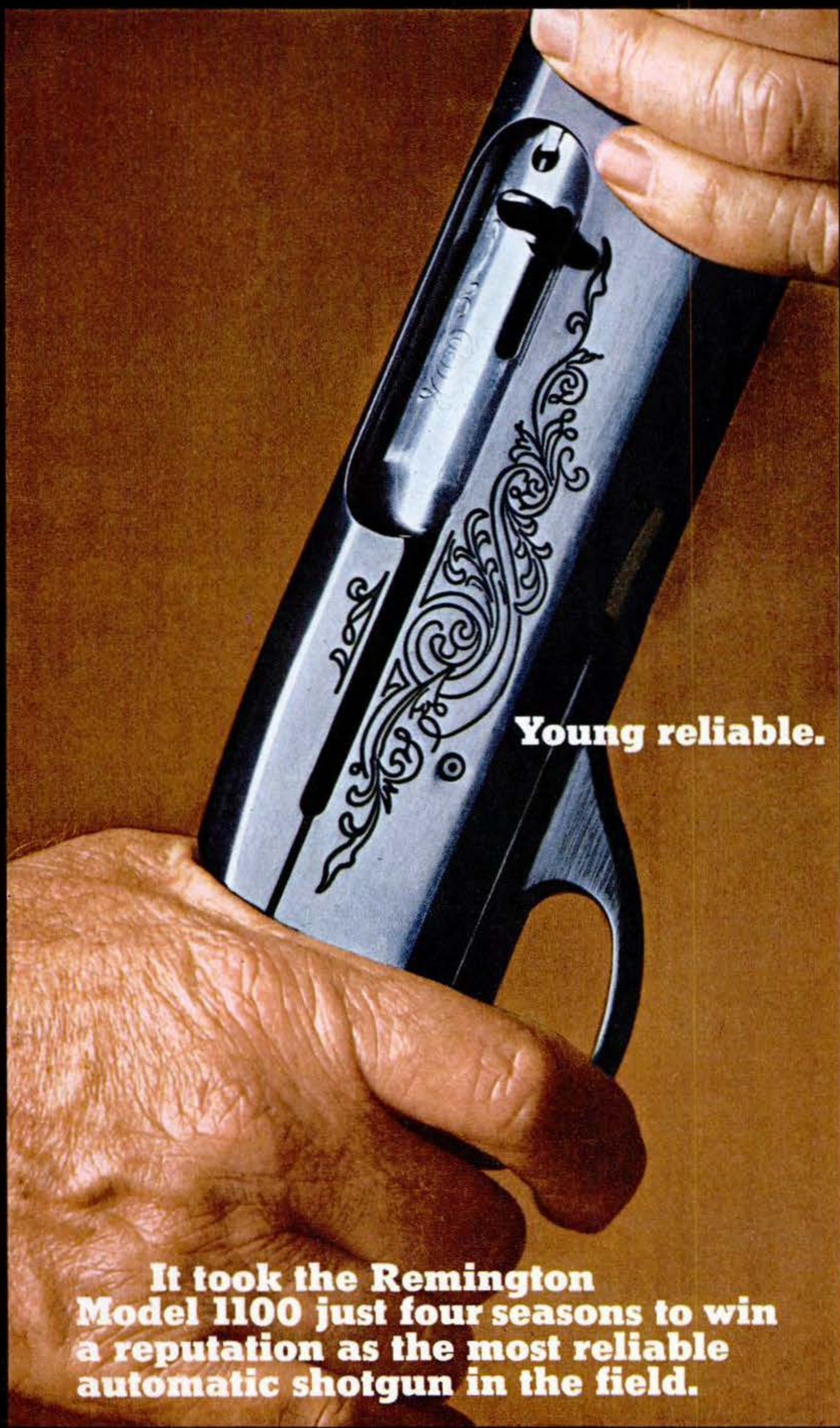

The Remington Model 1100 is just four years old.

Yet even the old-timers are calling it the automatic shotgun that doesn't quit.

Top skeet shooters can tell you all about 1100 reliability. Their guns often pound out more shells in a day than most guns see in a year. And they used more 1100's in the 1966 World Skeet Championships than any other shotgun.

For very solid reasons.

An 1100 receiver is milled from solid steel. Key parts are beefed up to take more stress. Working surfaces are highly polished to reduce friction. Points of greatest impact get special buffer "cushions".

And the new gas-operating system gives less "kick" than any other shotgun.

Check around. Others make automatic shotguns. But the Remington Model 1100 is made for keeps. From $159.95*.

Remington DU PONT

Write for free 1967 Remington Catalog: Remington Arms Company, Inc., Bridgeport, Conn. 06602. In Canada: Remington Arms of Canada Limited.
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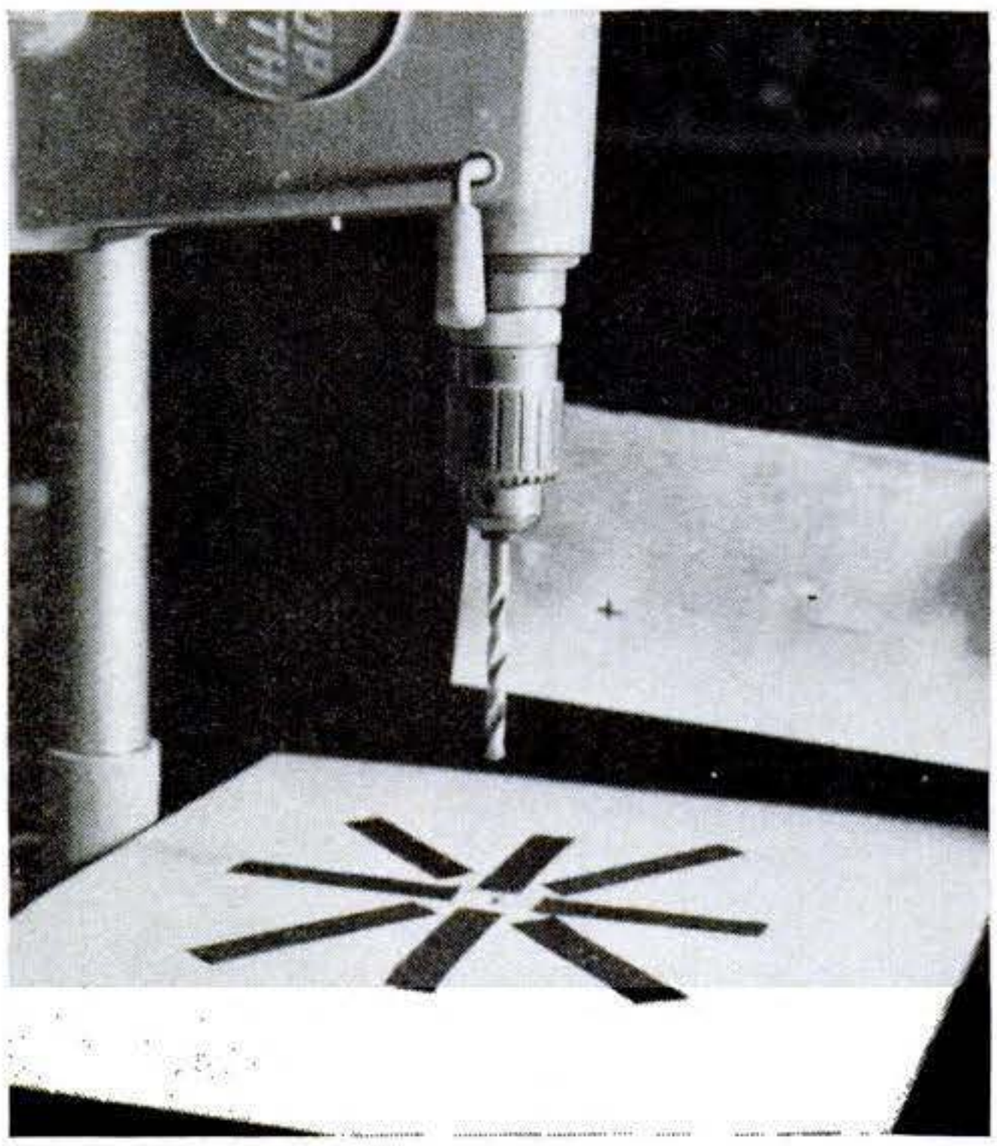
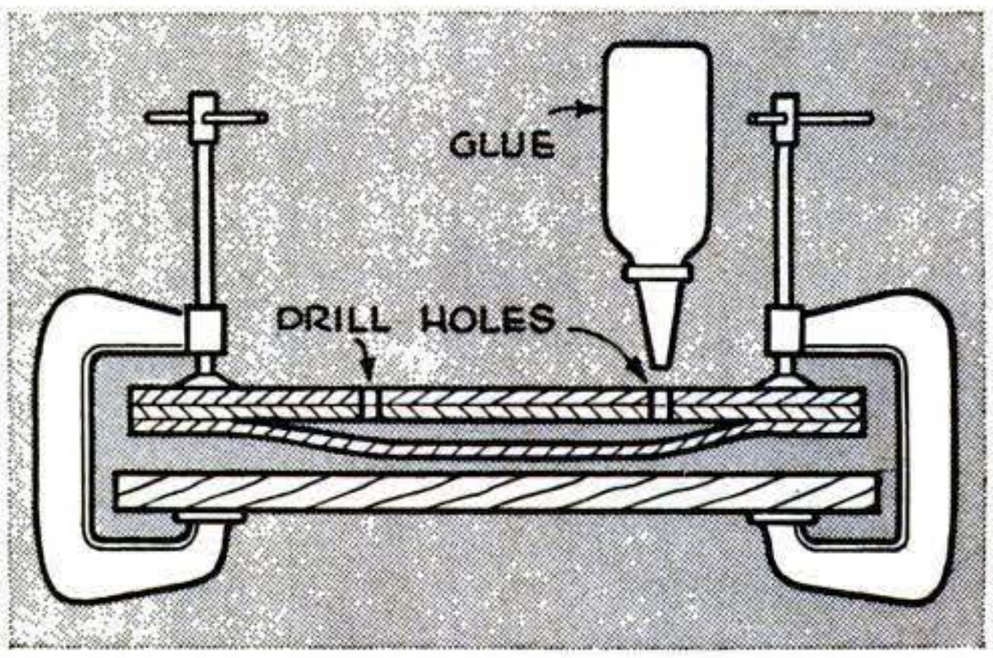


Surface clamp for drilling metal

When you're drilling thin metal, stick several strips of cloth electrician's tape or double-faced masking tape on the drill-press table to keep the work from shifting and twisting. Strips placed in a radial pattern, as shown above, provide the best grip.

JIM JOHNSTONE, Sunnyvale, Calif.



Glue makes invisible veneer repair

Blisters on a veneered surface are removed without a trace if you use this technique: Drill two ¼" holes in the wood behind the blister, being careful not to go through the face. Squeeze glue from a plastic squeeze bottle with a small tip into one hole until it starts to come out the other. Clamp a board over the blister and apply pressure gradually. Wipe off the excess glue and give the repair plenty of time to set.

ELWIN TRUMP, Wymore, Nebr.

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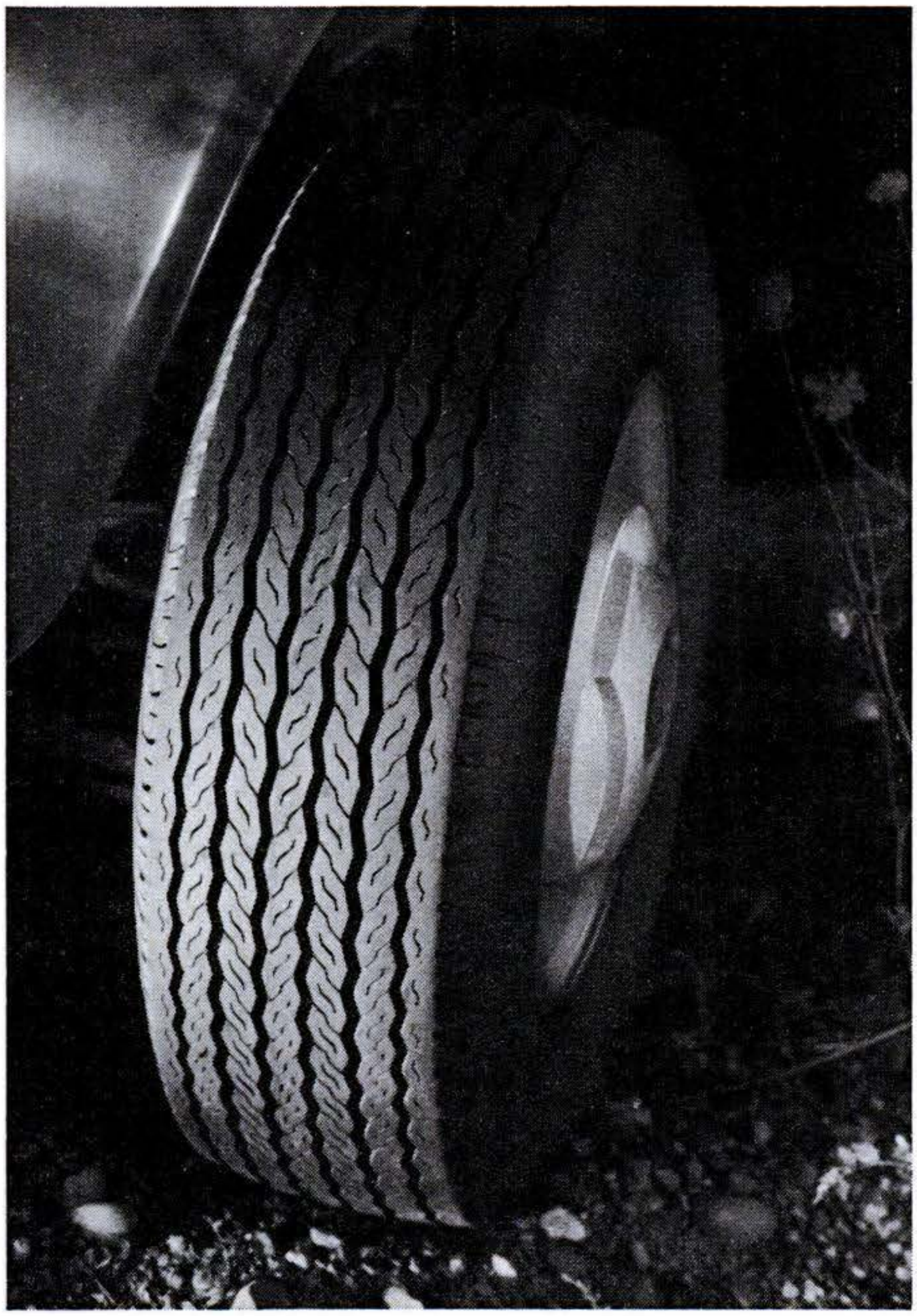
Now Firestone announces a truck tire built on the Wide Oval principle.



The Transport Wide Oval Truck Tire.

Now a new truck tire for pickup, delivery and camper trucks. New in concept. New in shape. The Transport Wide Oval truck tire. It's lower and wider than ordinary truck tires. Extra wide and Shock-Fortified to carry extra loads. The wider tread puts more rubber on the road. Gives sure traction, stability and safety. Gives you more flotation, too—lets you take your truck or camper where you could never go before. This new truck tire runs easier, too, uses less gas, and stops quicker. Trade for the Transport Wide Oval truck tire now at any Firestone Dealer or Store. Or, specify it for your new truck or pickup camper.

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Taller than king size.

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New Deep-Diving Sub:

Our First Ferry to the Bottom of the Sea

By EDWIN A. LINK
Inventor and underwater pioneer

A little yellow submarine named Deep Diver has just begun making sea history. The 22-foot, four-man craft is the world's first operational submarine that puts out divers to work on the sea floor and picks them up again—a feat performed in its successful initial trials off the Bahamas.

Here is a breakthrough in the conquest of the deep—a "taxi" for undersea construction and repair workers. And there are glamorous and dramatic uses—treasure hunting, lifesaving—for such a craft.

Continued

Diver has just emerged from submarine, which rests on bottom, in this underwater photo made during trial of Deep Diver off Grand Bahama, near Freeport. New undersea craft travels to and from operations area aboard a mother vessel, Link's 91-foot oceanographic yacht Sea Diver, which launches and recovers the 8¼-ton submarine with a small hydraulic crane.

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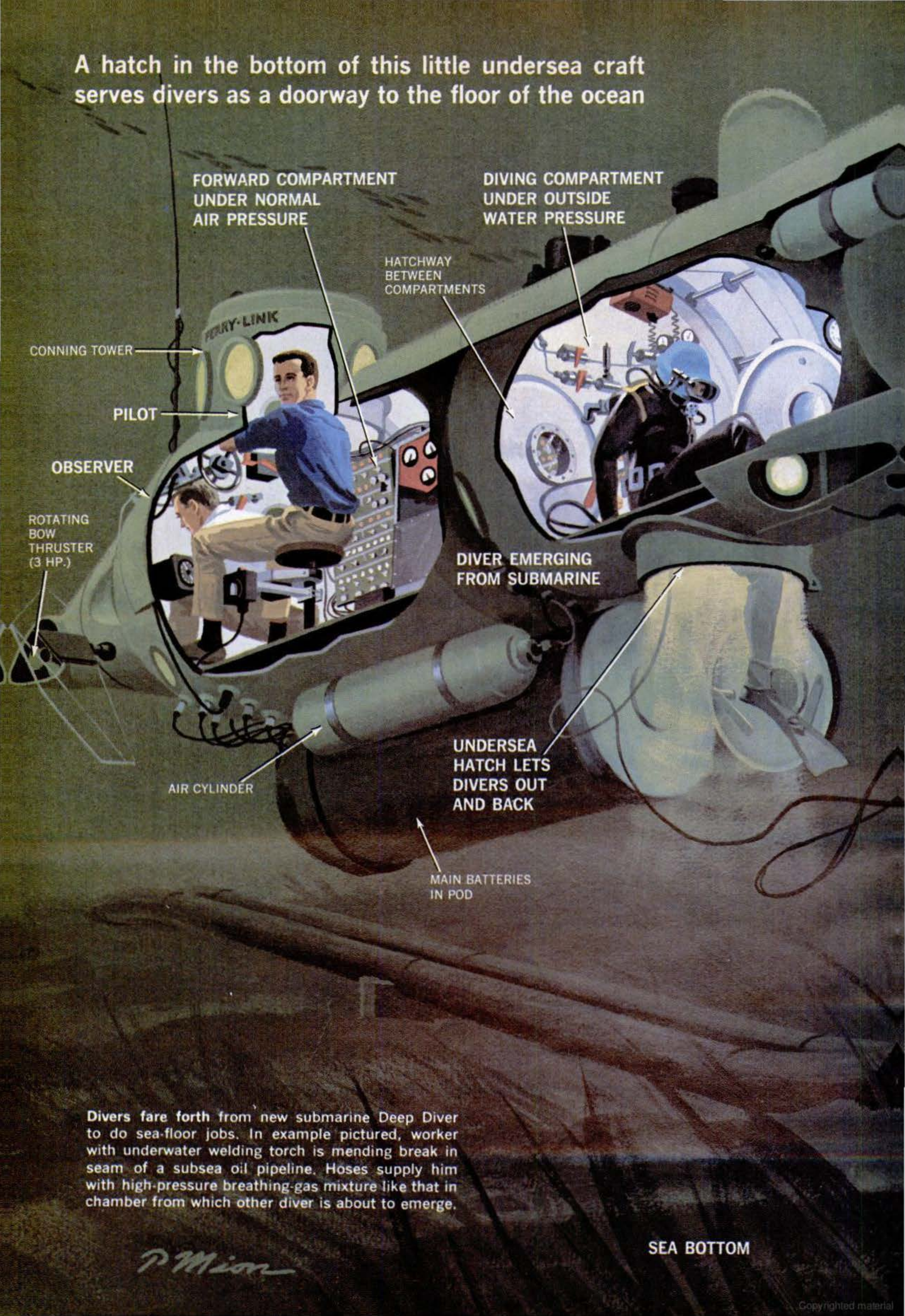
A hatch in the bottom of this little undersea craft serves divers as a doorway to the floor of the ocean



Divers fare forth from new submarine Deep Diver to do sea-floor jobs. In example pictured, worker with underwater welding torch is mending break in seam of a subsea oil pipeline. Hoses supply him with high-pressure breathing-gas mixture like that in chamber from which other diver is about to emerge.

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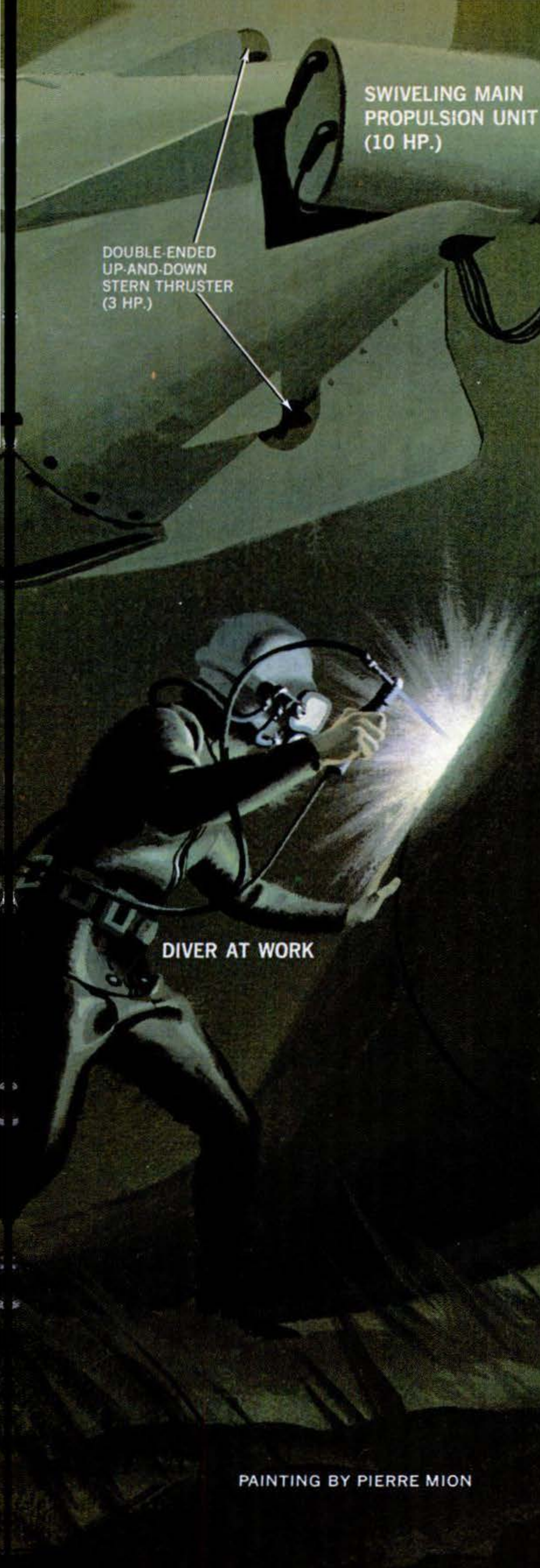

PAINTING BY PIERRE MION

I designed Deep Diver in collaboration with Perry Submarine Builders, at whose Riviera Beach, Fla., plant it was built. Its owner now is Ocean Systems, Inc., for whom I am Chief Marine Consultant. It combines two things in one—an underwater vehicle to take divers to the bottom, and a diving chamber for their use when they get there. Because of its dual nature, its pressure hull—4½ feet in diameter and of special ½-inch-thick "T-1" steel—consists of two separate chambers.

A pilot and an observer, Deep Diver's operators, occupy the forward compartment. They breathe air under normal atmospheric pressure throughout a trip to the depths.

Two divers ride in the after compartment. They breathe a gas mixture suited to the high pressure of the depths—a combination of helium, nitrogen, and oxygen.

Fiberglass fairing, open to the sea, encloses the pressure hull and such external appendages as ballast and trim tanks, and a high-pressure sphere that holds the divers' breathing-gas supply.

Door to the sea floor. A hatch in the bottom of the divers' chamber offers a doorway to the ocean floor. When Deep Diver has reached an underwater work site, and breathing-gas pressure in the diving compartment has been raised high enough to match sea pressure outside, the hatch may be opened without admitting water.

The two divers may then step from the hatch to the sea floor and carry out an assigned task there. Their work done, they reenter the submarine, and their diving compartment becomes a decompression chamber—where the gradual process of bringing them down to normal pressure can begin while the submarine heads back toward the surface. [Continued on page 170]

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'68 CARS: Some Chopped,

Buick LeSabre four-door hardtop has a new grille with more forceful lines but keeps its distinctive side sculpturing. Wheelbase stays at 123 inches. Standard V-8 engine will be more powerful for '68.

Buick Special two-door hardtop has totally new styling with touches of both Wildcat and Riviera.

Chevy II four-door hardtop has big-car styling, wider and roomier body; keeps single headlights.

Chevrolet Caprice two-door hardtop shows Continental-style rear quarters and rear fender spats.

Chevelle four-door hardtop has longer wheelbase, revised grille, and crisper, sharper body lines.

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Others Stretched, All Sportier

Last-minute changes in the lineup are still possible, and some new prestige models will be added

By JIM DUNNE / *PS Detroit Editor*

Would you believe it—there were a few things I didn't know when I told you about the '68 models last month. I keep finding new facts, and earlier reports are confirmed or proved wrong. Though the auto makers' overall plans for '68 are firm, it's not impossible to rush through a last-minute change to counteract a competitor's move. New models, such as top-line cars with prestige labels, can still be added. As we get closer to new-car announcement time, all the pieces in this great puzzle are beginning to fit together. The picture is almost complete now, and here are the latest hot flashes of Detroit news for you:

The Chevy II. Contrary to earlier reports, this car will have a completely new 1968 body, too. It looks exactly like the body GM is using for its intermediate cars. The Chevy II will come in two basic body styles, a two- and four-door sedan. Hardtops and convertibles are out. Best way to distinguish the Chevelle from the Chevy II is by the single headlight system on the smaller car. They look that much alike! If, as reports say, this is the intermediate GM body on the Chevy II, then the car will also have separate frame and body construction—a major change and a first for compacts.

Lincoln and Mercury. Lincoln's Mark III will be introduced late, as a 1968½ model. It will nearly duplicate the Cadillac Eldorado's dimensions with a 120-inch wheelbase and an overall length of 220 inches. Tires are 8.45 by 15 compared with 9.00 by 15 on the Eldorado. Warning lights are set in an overhead instrument panel above the windshield. The Mark III has coil springs all around

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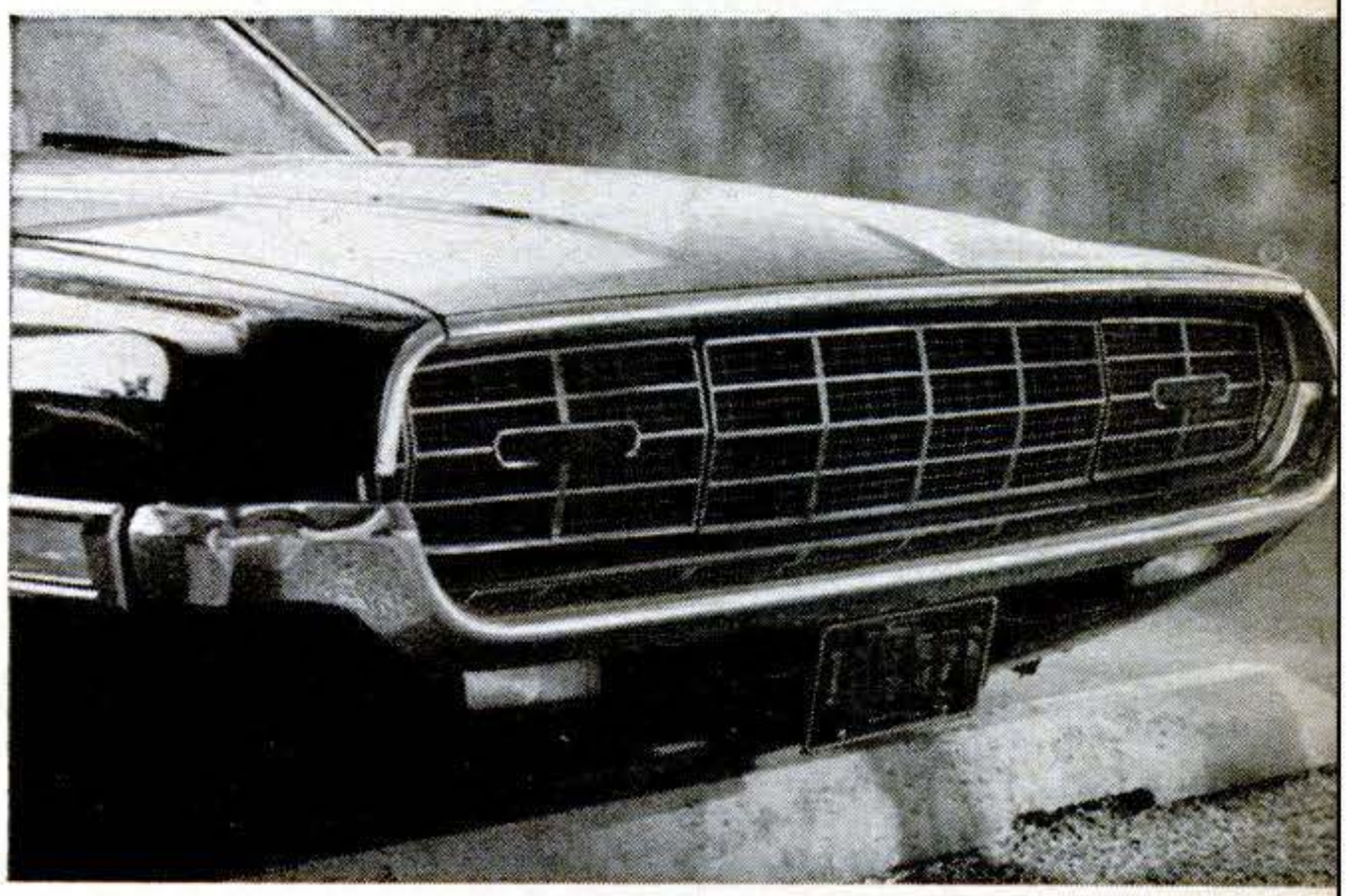
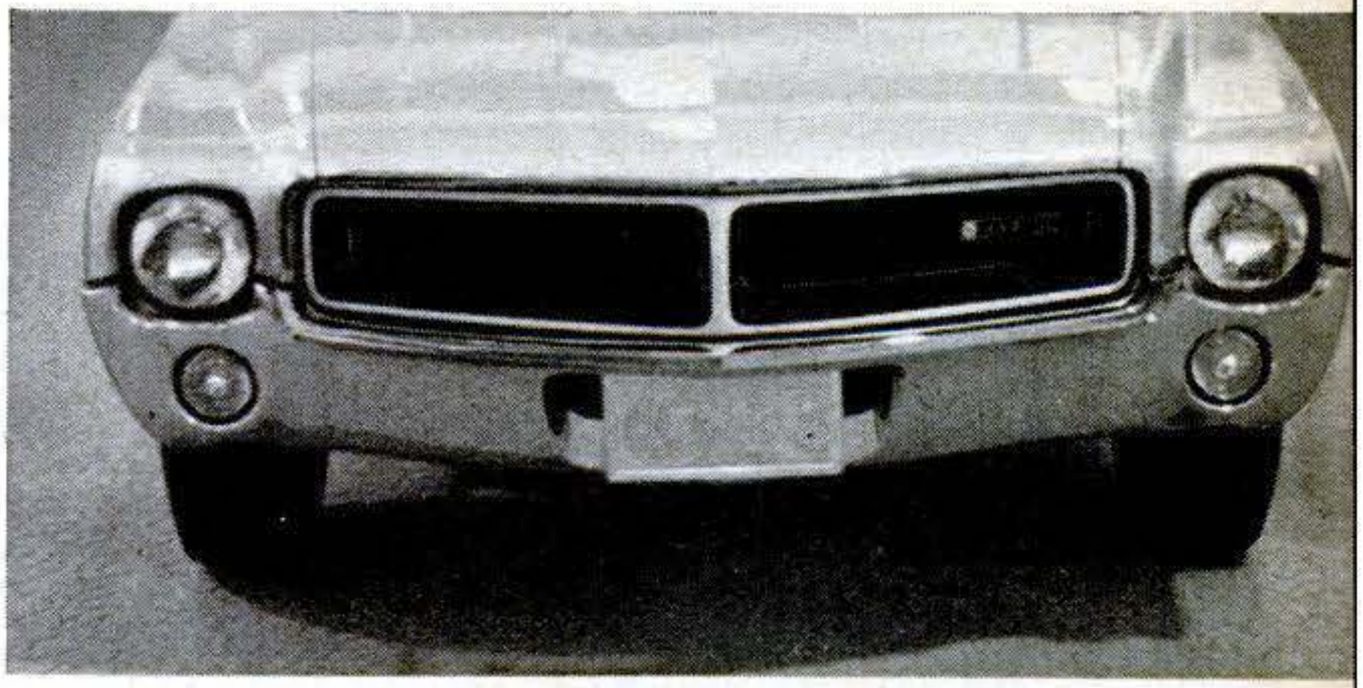


Thunderbird grille gets coarser "mouth-organ" mesh. No change in headlights, bumpers, or sheet metal.



American Motors' Javelin shows utter simplicity of frontal aspect, using single headlights.

Lincoln's Mark III grille occupies radiator area only. Flanking panels conceal dual headlights.

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New Corvette has a lower hood line, a cleaned-up grille and integrated bumper design, gill-less fender skirts, a new tail-end spoiler, and new type retractable headlights. Car is lower, longer, and some 50 pounds heavier.

supporting a lengthened version of the Thunderbird frame.

In the big Mercury line, Park Lane models will get a new, more severe fastback two-door hardtop roof and headlights that roll back into the grille when not in use.

Parking lamps on the '68 Lincoln are mounted on the leading edges of front fenders just above the bumper, and the grille has a coarser pattern. The grille is slightly changed on the T-Bird, untouched on the Cougar. Biggest change inside the T-Bird is the front bench seat now offered as standard. Besides eliminating the bucket seats in front, this does away with the center console that flows up into the instrument panel. A fold-down center armrest is standard with the bench front seat.

"Montego" is the name of a new Mercury intermediate top-of-the-line model.

The Fairlane. Next year's model is greatly changed inside as well as in outer skin. Interior door handles are recessed inside armrests for safety reasons, and hidden completely from view, similar to the present Camaro. Instruments are recessed, too, deep inside four cushioned pods right in front of the driver. On four-speed Fairlanes, the shift lever is extra long so the driver does not have to reach when shifting.

The Charger. Chrysler's styling leader for 1968, the all-new Charger, is startlingly different from the '67 car. It has a recessed, plastic grille, recessed backlight (a la GM's present intermediates), a hint of an air spoiler at the rear edge of the trunk lid, and a definite Chevrolet look from the rear. The Charger's roof line has been changed from full fastback to semi-fastback. An interesting feature is the gas-cap location. Dodge has placed it atop the fender at the front corner of the trunk. The cap itself is extra large and heavily chromed, and no effort was made to blend it in with the body lines of the car. Unlike some competitors, the Charger will keep its front vent windows.

Inside, the Charger's sporty layout has been abandoned in an obvious move to reduce the selling price. Standard seats are bench, front and rear, replacing the buckets and full-length console. The rear seat with the flexibility to form a flat floor clear back through the trunk is no longer available on the Charger.

The Corvette. One of the most exciting cars next year is Corvette. Its styling is completely new. The fiberglass body has been stretched seven inches by lengthening the nose of the car. This probably accounts for most of the 50 pounds of added curb weight. New features of Corvette include door openings that extend deeply into the roof to aid entry and exit, a bob-tailed rear end with air-spoiler lip, and a

Mercury Monterey sports a new grille with increased Lincoln influence and a semi-fastback hardtop body that is based on the LTD.

Mercury Comet shares the full-si Mercury's profile on a smaller scal

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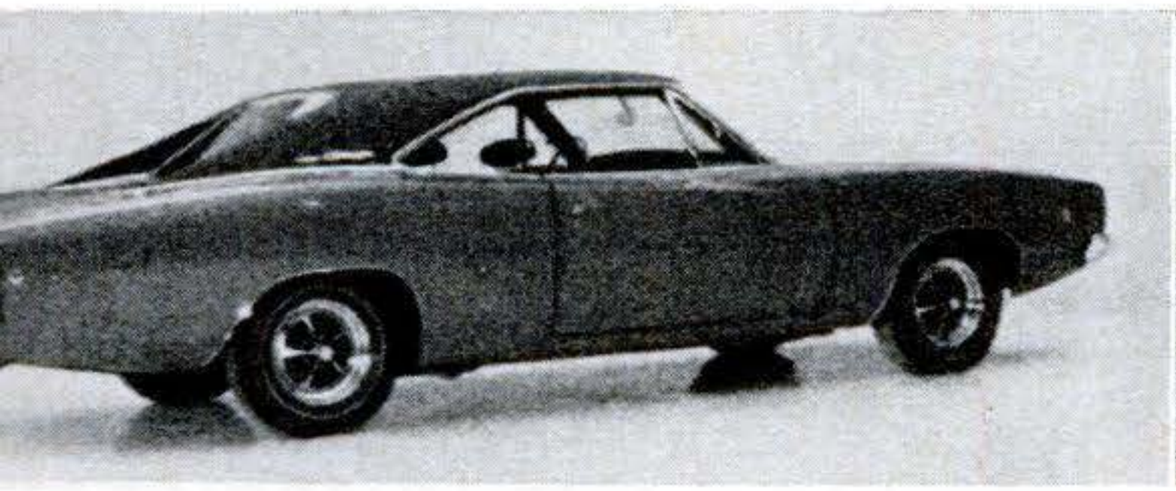
Ford's LTD has longer front overhang with a new full-width grille and retractable headlights.

Fastback LTD? Valances around car's backlight give fastback profile yet assure you a normal rear view.



Dodge Charger has all-new body with the fenders and backlight treatment reminiscent of GM styling.

Charger grille remains full-width but is lowered and gives a less brutal appearance than old model.

detachable roof for the convertible that exactly matches the styling of the hardtop.

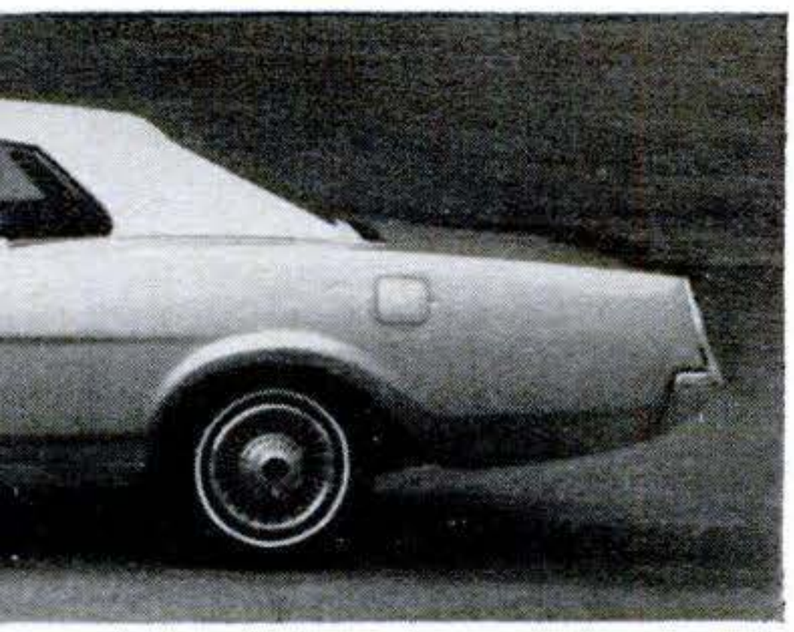
Grand Prix. Pontiac's Grand Prix will stick with hideaway headlights, but otherwise its grille will be identical with the other Pontiacs. With this move, the whole Pontiac line, from Firebird to Bonneville, will have a one-theme grille—a heavy chrome bar circling the grille with a vertical chrome bar splitting the grille down the middle. Except for these changes and the all-new Tempest line, '68 Pontiacs are little different in appearance.

Several lines of full-size GM cars will have a new AC electric fuel pump. It is immersed in the tank, needs no maintenance, and, it is claimed, eliminates vapor lock.

Modified grilles and rear ends tell most of the story for Chrysler Corp. big cars.

A new four-barrel carb. Available on some Chrysler Corp. V-8s is a carburetor that acts more positively in opening the secondary barrels when extra power is needed. Called AVS for Air Valve Secondary, it's made by Carter. Not only does it furnish more power, but its precise operation is more economical since it delivers fuel exactly when it can be used. Key to the new carb is an air valve that opens the secondary barrels on demand from the engine instead of by accelerator pressure.

New engines. Chrysler's lineup will take on a new 340-cu.-in. V-8 for use as the main power plant in the Barracuda line. This is a bored-out version of Chrysler's 318-cu.-in. job (redesigned last year). Also new in the engine lineup are hydraulic tappets for the 273-cu.-in. V-8, the last of the Company V-8s to get them. All the other V-8s—440, 383, 426, 318—will be offered again next year. PS



ith a more conservative roof line. he familiar vent windows are gone.

Buick Special chassis for four-door bodies has been stretched to 116-inch wheelbase. Side sculpturing is borrowed from the big Buicks.

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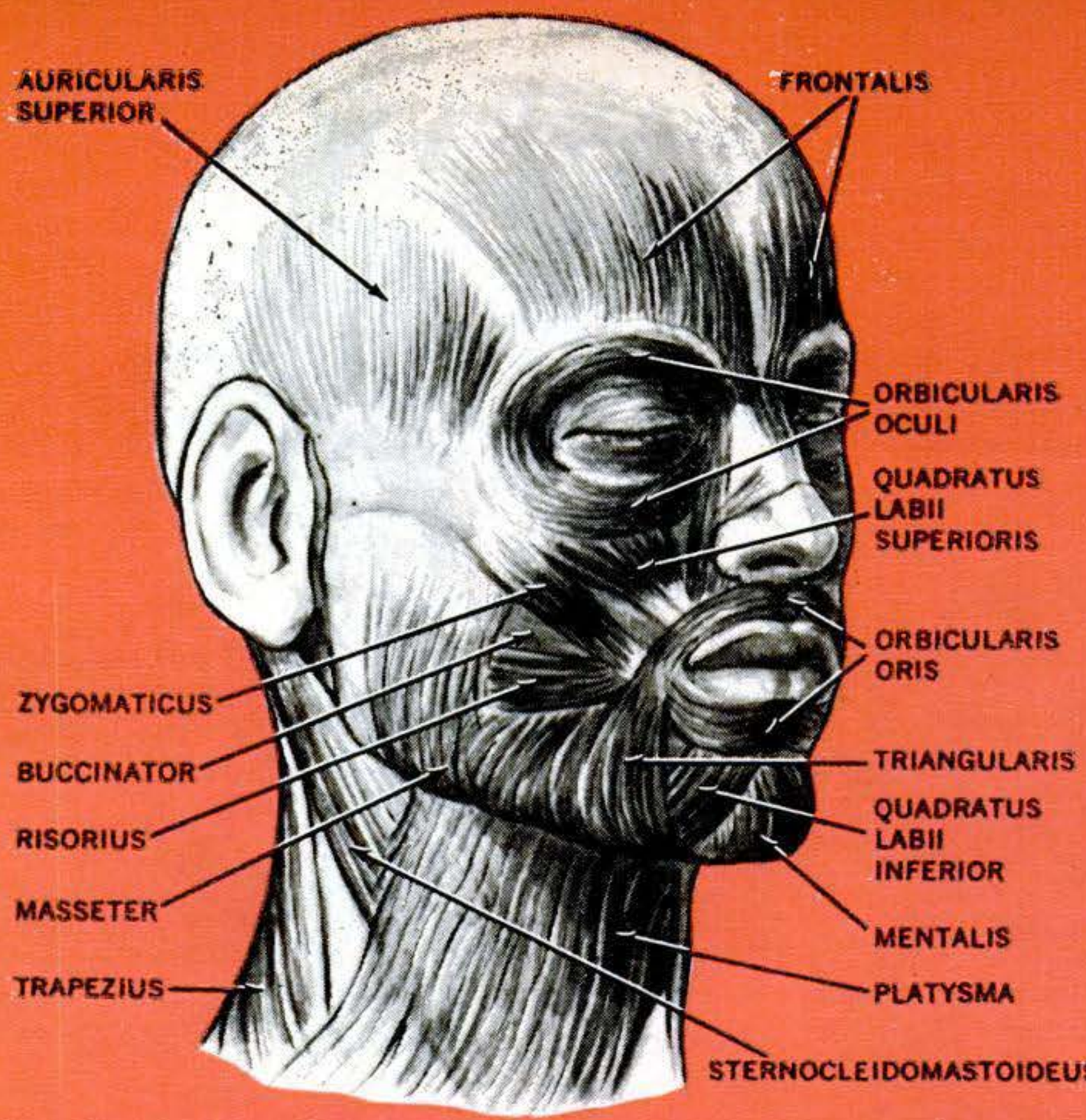

Illustrations courtesy of Today's Health, published by the American Medical Association

THE MUSCLES OF EXPRESSION

Surprising New Facts About Your Muscles

Here's a fascinating look at how your more than 600 muscles work—and some ways to get more out of them

By LAWRENCE GALTON

Your muscles are wondrous stuff. Given the right wing equipment, you could fly. You have the muscle power for it. A physiologist at University College, London, not long ago figured out that it would take 0.4 horsepower for a 175-pound man to fly, and that the average man's muscles can produce that much power for as long as 30 minutes.

Few things are as basic to life as muscles. Recently, investigators have been amassing considerable new information about what goes on in your muscles, what they can do, what's good for them, and what things can go wrong with them.

It's by muscle contraction that your heart pumps blood, air gets sucked into your lungs, food is pushed along the digestive tract. Muscle contractions also make you laugh, squeeze out the tears when you cry, focus your eyes when you read (see illustration above).

You have more than 600 muscles. Look at one under a microscope and you'll see that it's made up of a mass of elongated fibers. All told, there are about six trillion fibers in the body, each no thicker than a hair, yet capable of supporting 1,000 times its own weight.

When a muscle contracts, it shortens by as much as a half. Investigators have found that a single contraction raises

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An inside look at some of your 600-odd muscles

When you wink, sneer, or smile, like the man at left, it's done with small bundles of muscle fibers around your eyes, mouth, and nose. Your major muscles (shown in the drawing at right) include the sartorius—longest in body—which allows you to cross your legs.

the temperature of muscles a few thousandths of a degree. The human muscle has about the same efficiency as the best car engine in converting fuel into energy—about 30 percent—with the rest going into heat.

The basic fuel in muscle is glycogen. It comes from food and is stored in muscle tissue. The energy needed for muscle functioning comes from the reaction between glycogen and oxygen brought in via the blood. The energy is released as the reaction goes through a series of stages until only carbon dioxide and water are left.

In vigorous activity, you use up energy so fast that you can't get enough oxygen into the muscles—even though air intake through your lungs shoots up to 100 quarts a minute (from six to eight at rest). Then your heart increases its pumping work by as much as 600 percent to rush more oxygen-

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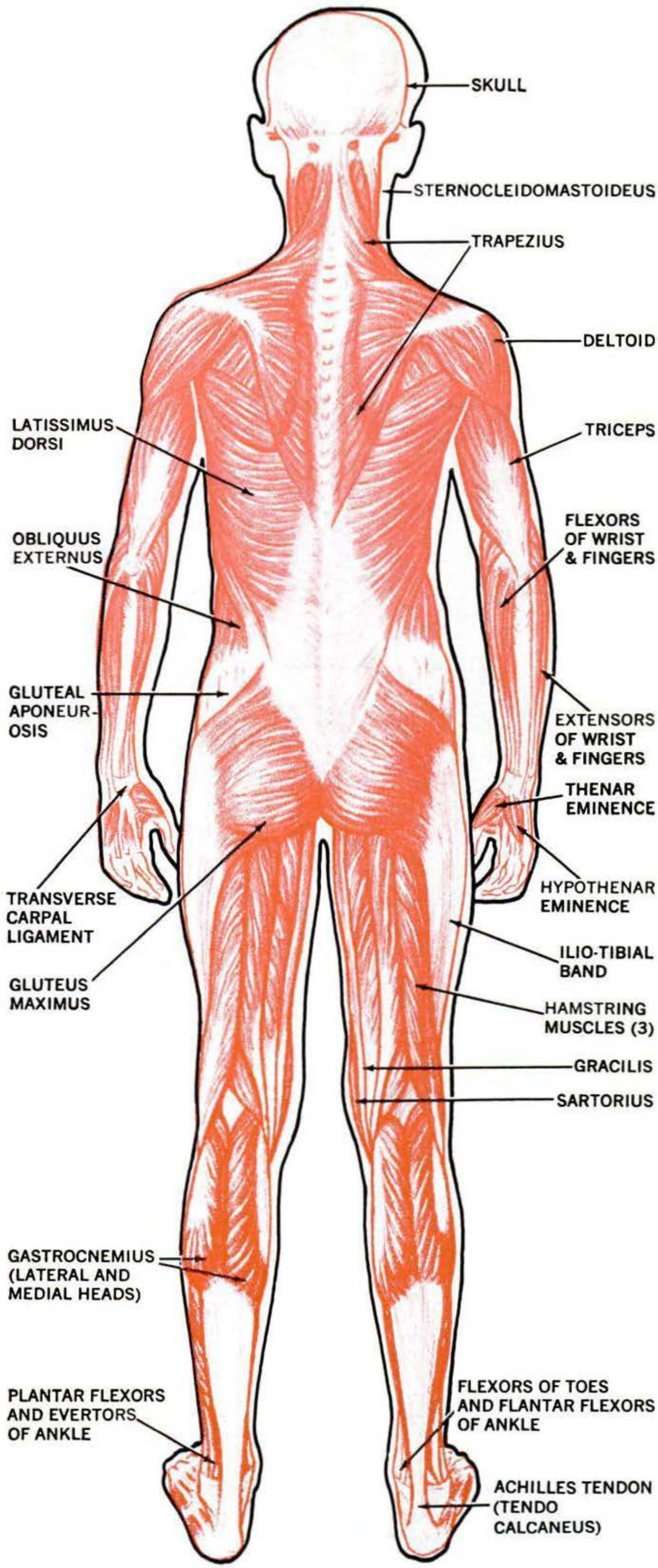

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laden blood to the hard-working muscles.

When muscles age. Muscle strength varies, of course, between the sexes and also with age. For both sexes, strength increases rapidly in the teens, continues to increase (but more slowly) in the early twenties, reaches a maximum in the mid to late twenties, after which it remains level for five to 10 years and then declines slowly.

Studies indicate that a woman trying hard enough can achieve about 60 percent of the maximum strength of a man. But women tend to lose more of their strength with age than do men; by 65, when men still have about 50 percent of their maximum strength, women have lost all they gained from the age of 10 on.

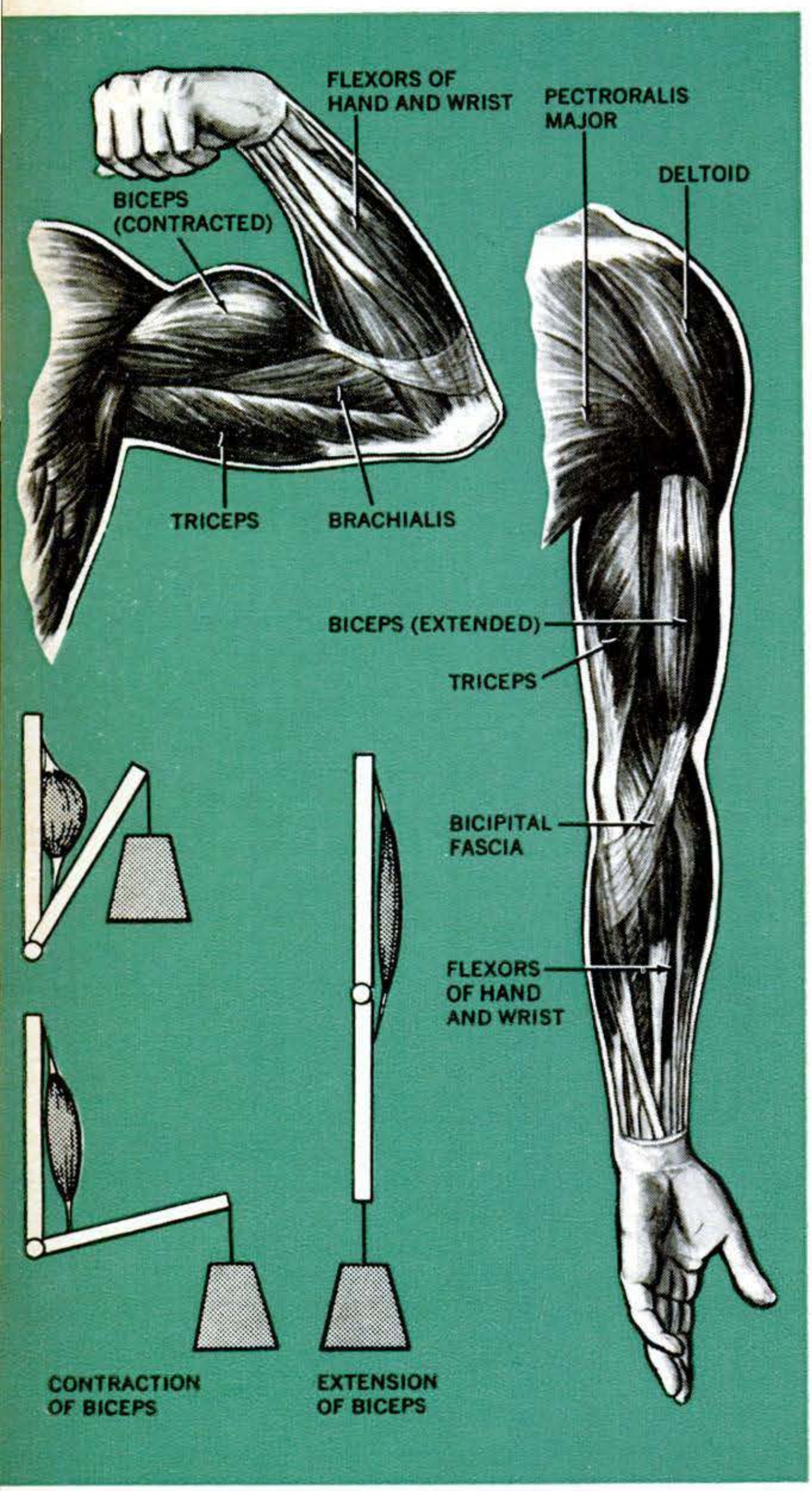
Muscular strength depends upon use. Latest studies with isometric exercises—in which muscles are tensed without movement—indicate that if maximum tension is exerted for six to 10 seconds at a time and the exercises are repeated several times a day, it's possible to increase strength at the rate of about 10 percent a week.

No less important than strength—for the athlete and for you—is stamina. Stamina, or endurance, is built by continuous activity which stimulates the lungs to increase their volume, conditions the heart to push more blood to the muscles with each beat, and even increases the efficiency with which muscles pull oxygen out of the blood, all adding up to increased ability of muscles to function longer with less fatigue.

Muscle-building techniques. Isometric exercises can be used to build muscular strength. So can old-fashioned (but still sound) isotonic exercises such as push-ups, pull-ups, and sit-ups. Go through a series of isotonics at a brisk pace and you can work up to a huffing-and-puffing stage, building up endurance, too. And various noncalisthenic activities and games also can be used for endurance.

Not golf, though. Too much standing around and walking. Still, playing golf, you burn up considerable energy—about 223 calories an hour—3.9 times greater than the amount burned when you're doing nothing, just resting. That's better than archery (169 calories), bowling (190), volleyball (210). On the other hand, canoeing (420 calories), cycling (410), jogging (679), and even brisk walking (334) are all useful for building endurance.

Feeding your muscles. Recently, scientists have debunked old misconceptions about muscle care and feeding.



The biceps and triceps move your fingers. The biceps can bend the elbow, but to straighten it, the triceps must contract.

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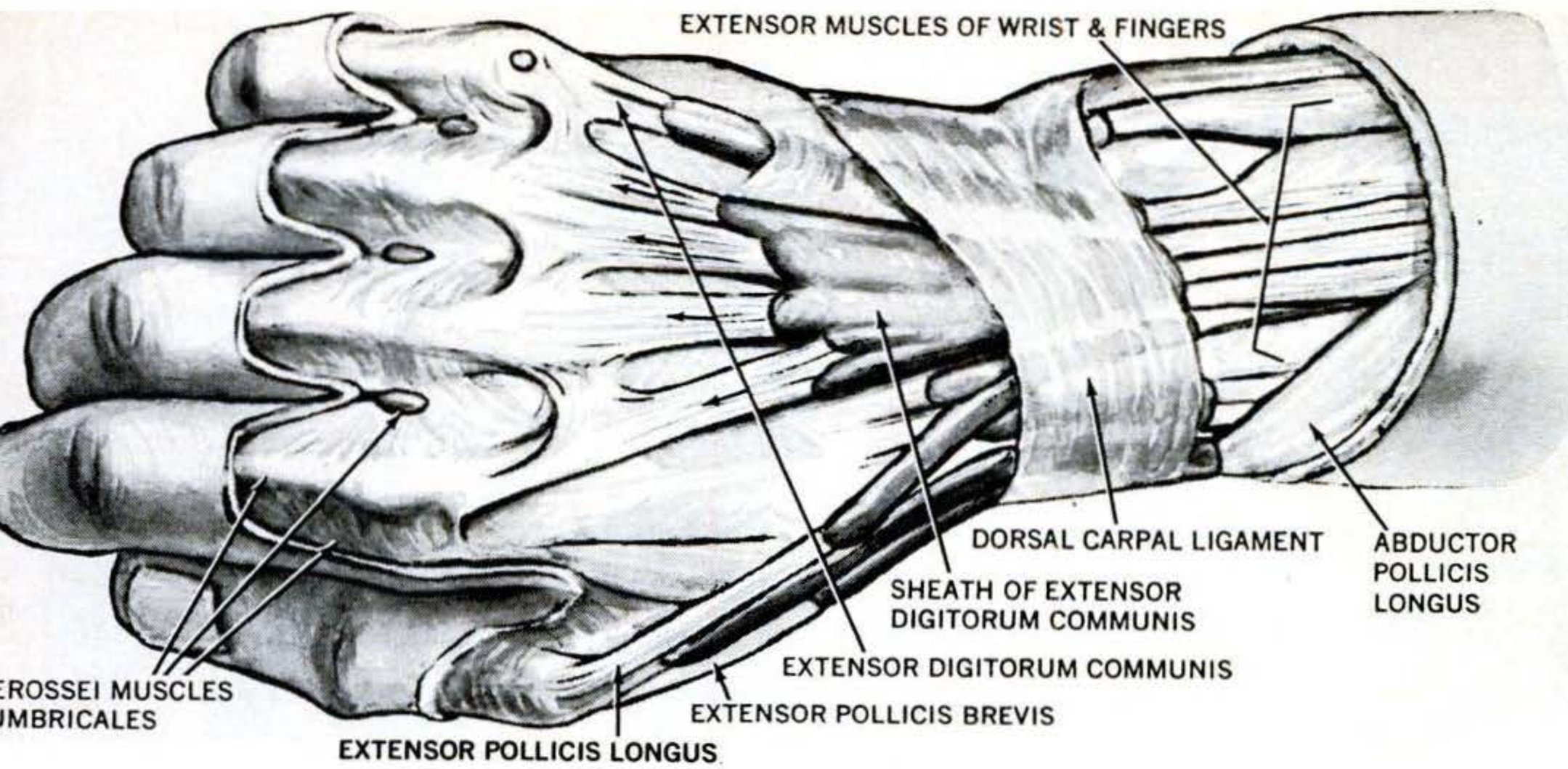

Hand muscles do double duty of sheathing the tendons and allowing movement of the fingers.

In its latest handbook on athletic training, the American Medical Association points out: "Contrary to traditional ideas, research indicates that 'going heavy' on protein in the training diet serves no useful purpose . . . Protein, as was formerly believed, does not seem to be the chief source of muscular energy."

Actually, investigators have been finding that during exercise what's needed for burning is carbohydrates (sugar, starch)—and that virtually no protein is burned. Which is a good thing. Because when carbohydrates are burned, the waste products are carbon dioxide and water, and these can be gotten rid of through the lungs and the skin. But when proteins burn, there is a residue of acid that can only be excreted through the kidneys—and kidney function stops during exercise.

Another old mistaken notion is that drinking water before or during strenuous physical exertion is bad. On the contrary, it's good. During hot or humid weather it can help avoid heat stroke. And in studies last summer, investigators at the Physiology of Exercise Laboratory at the University of Toledo, Ohio, made a surprising discovery: Drinking cold water before or during an athletic event actually led to better performance.

What about warm-ups? Warming up and tapering off also have come in for new looks. Scientists haven't determined yet whether warming up improves athletic performance, but they do know that it serves another important purpose—safety.

Light warm-up exercises limber up muscles; they also get the heart and lungs ready to sustain exertion. As one investigator puts it, they're the equivalent of what the airplane pilot does when he taxis out to the runway, then stops and guns each engine. "He is bringing components up to optimum temperature and pressure ranges . . . an obvious safety measure." Warm-up exercises also contribute to safety by tuning up the nervous system. When you move one muscle, a second one—antagonist of the first—should relax its tension properly to avoid injury.

There's also evidence now that tapering off serves an important physiological function. When you're exercising vigorously, your heart is pumping blood faster to the muscles. And after leaving the muscles, the blood enters the vein system to return to the lungs and heart. While you're exercising, the contracting muscles press on the veins and produce a pumping action that helps get the blood back fast enough for another go-around.

If you stop activity suddenly, the heart for a time continues to pump blood fast, but the muscles, no longer active, don't help the blood get back—and there may be enough pooling of blood, especially in the legs, to cause a temporary shortage elsewhere, making you feel faint,

[Continued on page 186]

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Famous conductor has one-handed clock

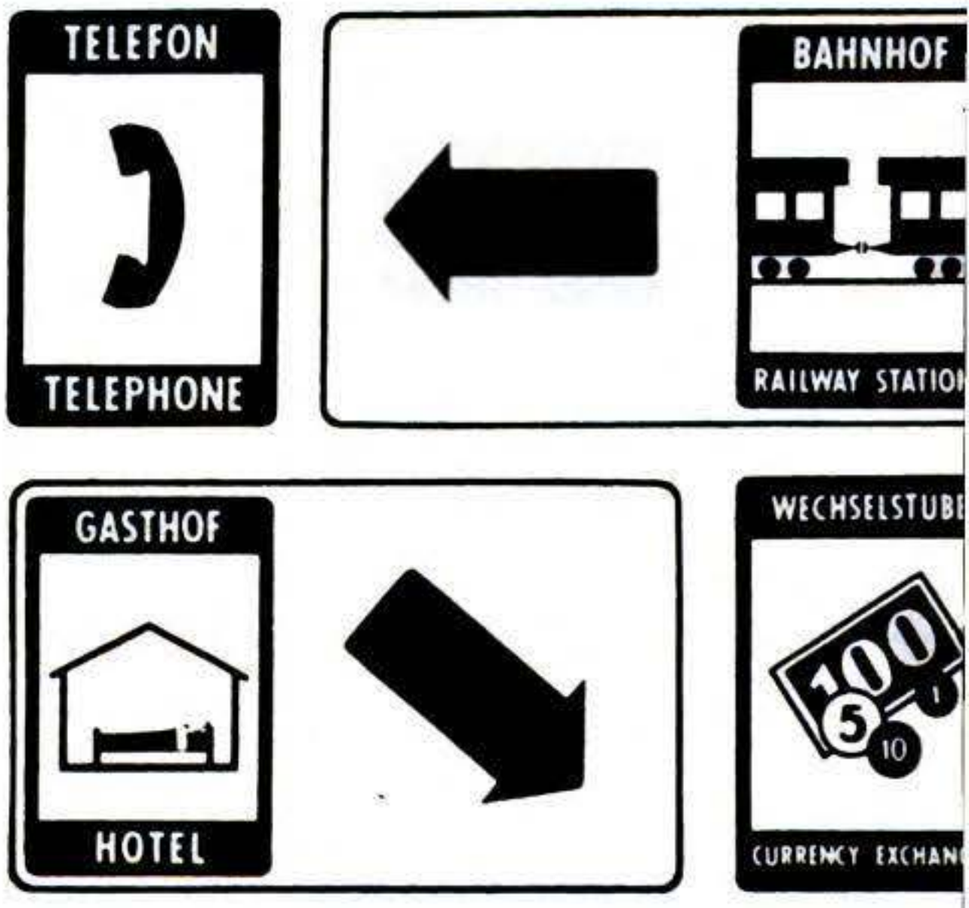
One of the world's great musicians, Leopold Stokowski, searched for years for a one-handed electric clock. To him, minute and second hands were superfluous. He didn't find one. So he built his own. He buried an electric motor in one wall of his New York apartment and painted a giant dial face on the outside, as shown above.

Cycle signal mast

Here's a boon to the motorcycle rider who finds himself in dense auto traffic with nobody paying any attention to him. It's a stop-and-turn signaling mast seven feet high, made by the Speedway Safety Devices Co., 1303 McKinley, Des Moines, Iowa.

Fancy-pants 150-m.p.h. executive chopper

The latest thing in executive transport at 150 m.p.h. is this Hughes four-seat helicopter with ultramodern styling. It also—of course—totes a pilot and luggage, and can go 450 miles between gas stops. The military version of the craft, from which it was adapted, claims 23 world records in speed, rate of climb, and distance.



Airport signs proposed to en passengers' confusio

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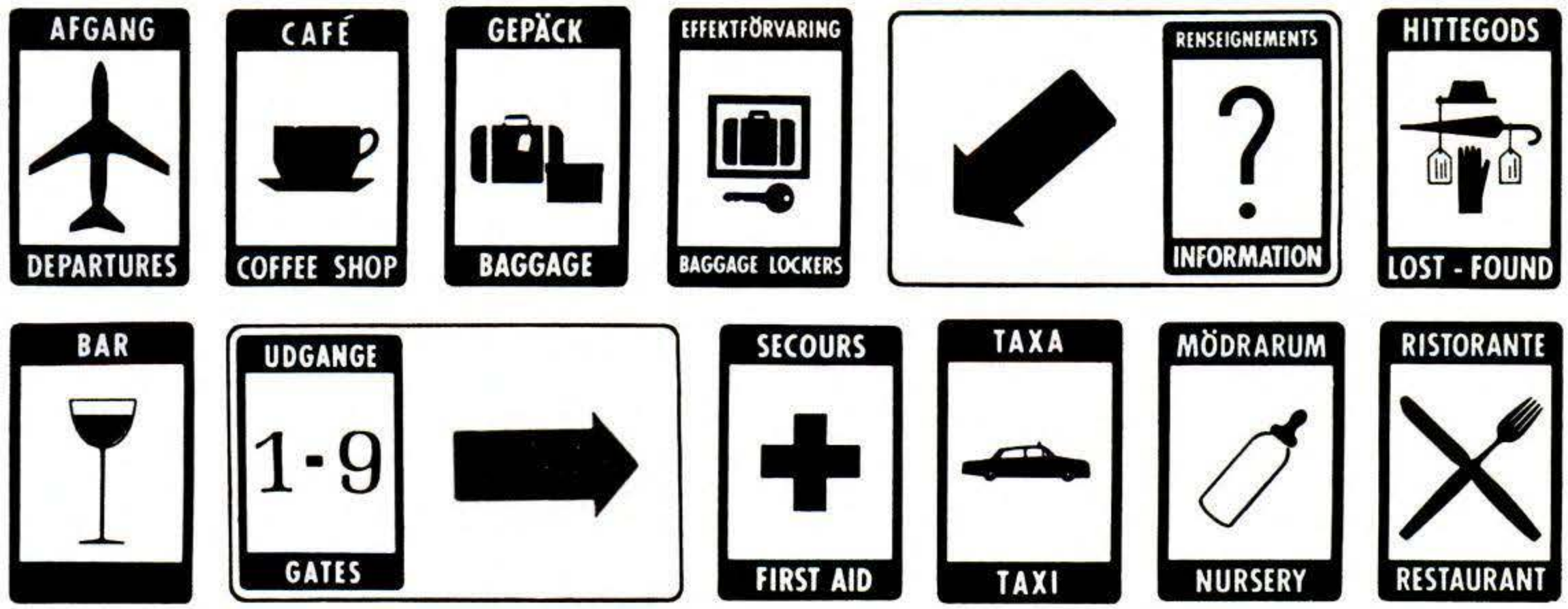
"Carpet" of light illuminates a San Francisco bridge

It's like driving on a luminous road that is almost without glare when you cross the new San Mateo Bridge spanning San Francisco Bay. The motorist enjoys continuous light instead of going from one pool of light to another, with darkness between. The light source is "continuous luminaries" built into a 30-inch-high barrier dividing opposing traffic. Wellmade Metal Products and the State of California devised the system.



Airport signs throughout the world frequently are so much gibberish to the traveler. To end the confusion, the International Air Transport Assn. proposes that airports use picture symbols, interpretable whether a person speaks English or Hottentot. Yet the passenger may have a question: What's a railway-station sign doing at an airport?

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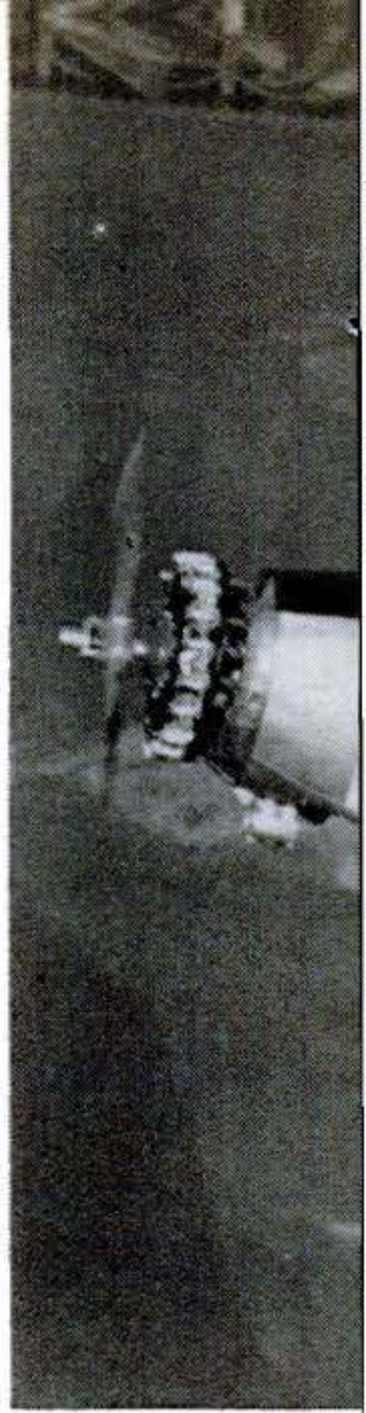
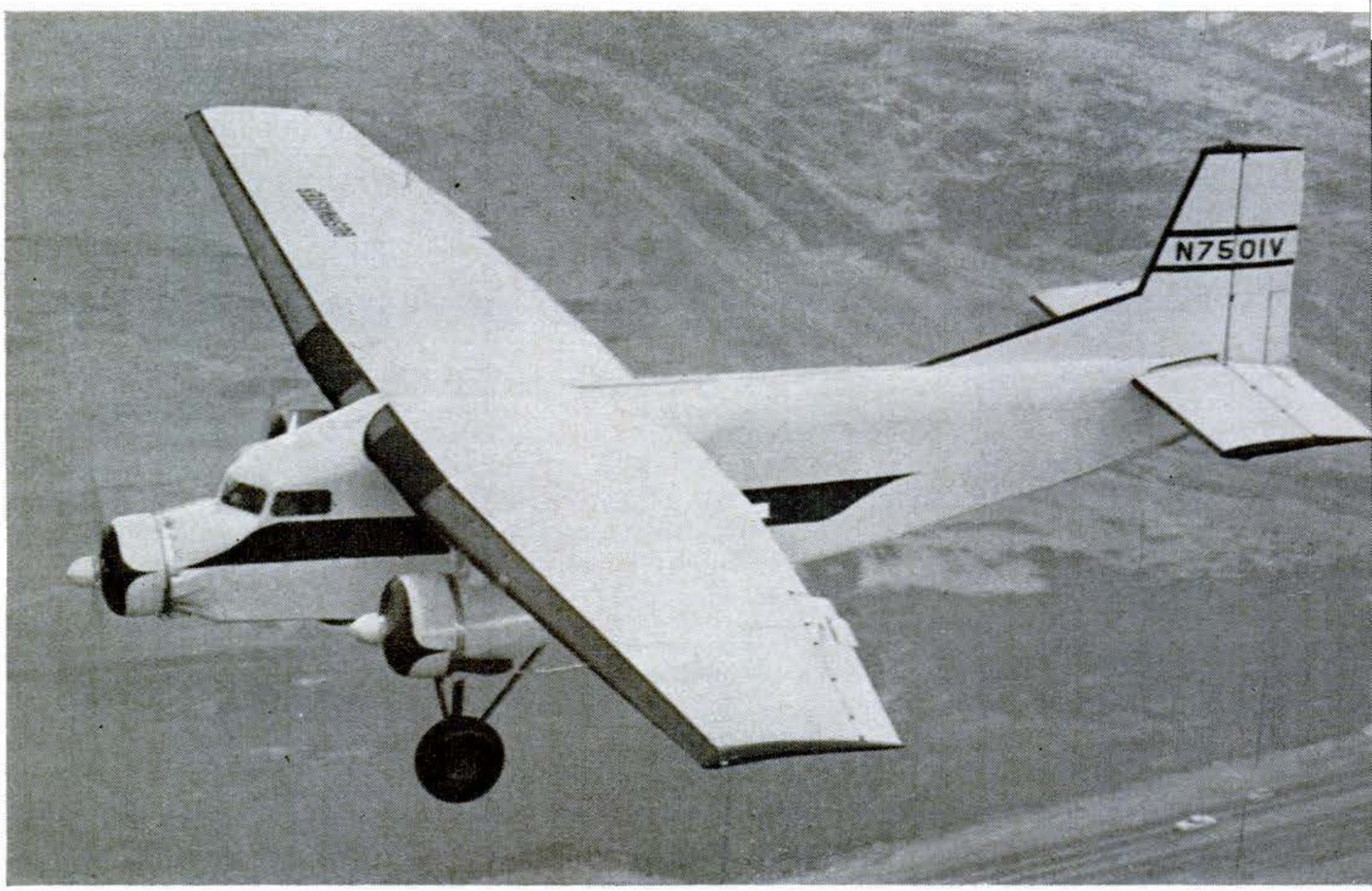
TIN GOOSE weighed 13,500 pounds fully loaded, cruised at 122 m.p.h. It carried 13 to 15 passengers in removable wicker seats. Only two of its three 420-hp. engines carried cowlings. At one time it was the world's fastest multiengine plane. Wing compartments carried cargo.



The "Tin Goose" Comes Back

BUSHMASTER looks like the old Ford. It should—it's almost a copy. In an age of jets weighing hundreds of tons and flying at 600 m.p.h., the new tri-motor grosses 12,500 pounds, cruises at 146 m.p.h. It is 49½ feet long. The three engines produce 450 hp. each.



Thirty-five years ago the most famous transport plane in the U.S. was a tri-motored giant (for its day) nicknamed "The Tin Goose." It was made by Henry Ford the Elder.

The Tin Goose is back. A lineal descendant of the old Ford, it looks just about the same, right down to the corrugated aluminum-alloy skin. It's the same size. It's a little sleeker, of course, a little faster, and the control cables that used to slap against the outside of the fuselage now nest in inside conduits. But the engine power is almost the same in this reincarnation, called the Bushmaster 2000, and it still has a tail wheel—when all other transports rest on tricycle gear. It carries 15 persons.

Ford built 196 Tin Goose planes between 1925 and 1932. In 1929 Charles A.

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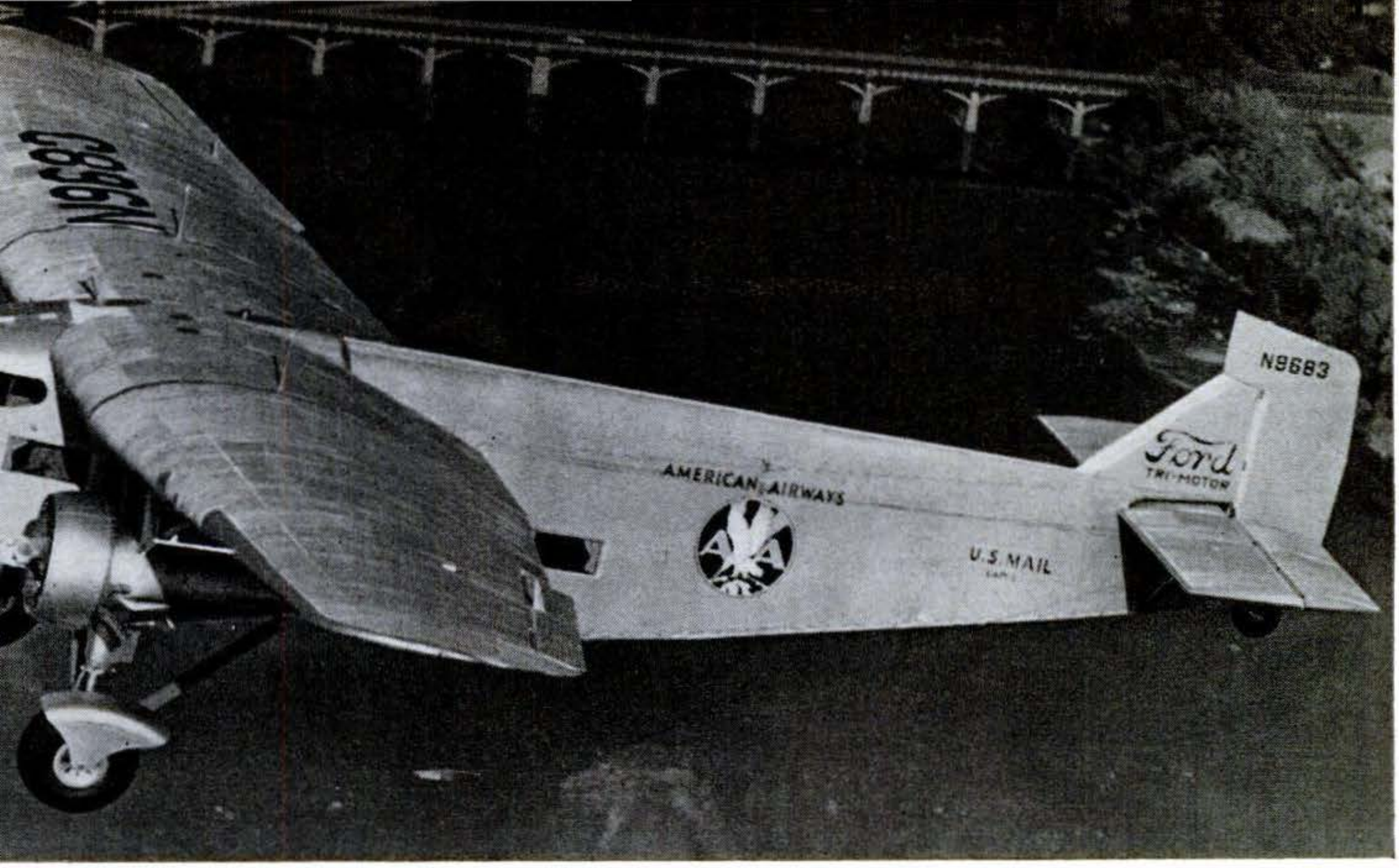

Early-day picture in front of a Transcontinental Air Transport Ford with its unretractable landing gear (duplicated in the Bushmaster) contains some notables—and see if you can pick them out. They are Douglas Fairbanks Sr., Anne Morrow Lindbergh, Mary Pickford, and Charles Lindbergh.

Old Ford's single seats, like Bushmaster's, flanked narrow aisle. Airline showed no movies en route.

Lindbergh piloted a Ford Tri-Motor in the inaugural flight of the first scheduled, transcontinental passenger service. For years, most airlines used this plane. Dozens of the originals are still in service hauling freight and passengers in the U.S. and in Central and South America.

The Bushmaster, made by Aircraft Hydro-Forming, Inc., Gardena, Calif., is designed for the same kind of jobs.

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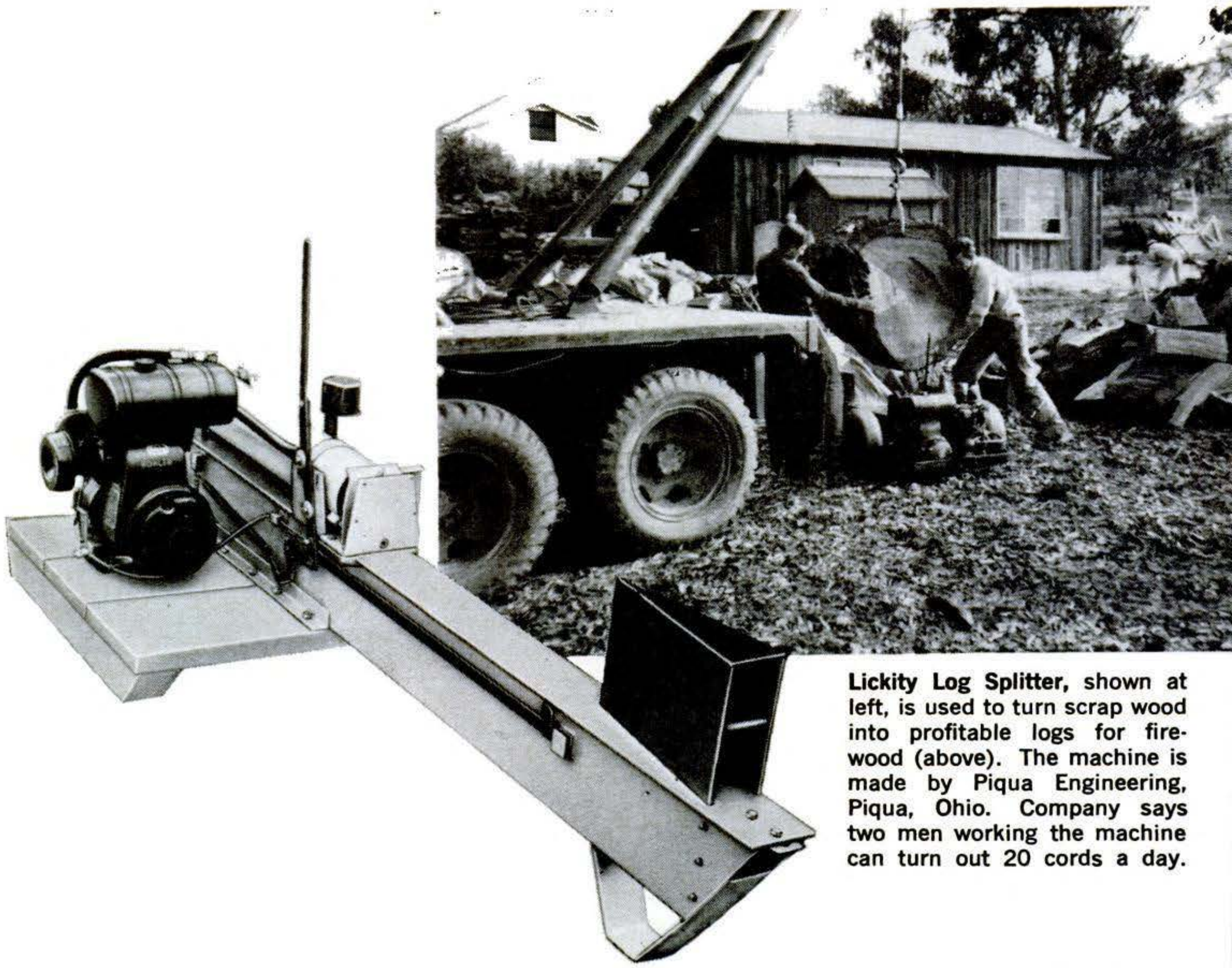

Lickity Log Splitter, shown at left, is used to turn scrap wood into profitable logs for firewood (above). The machine is made by Piqua Engineering, Piqua, Ohio. Company says two men working the machine can turn out 20 cords a day.

Machines That Make

Here's how many mechanically inclined men are using their spare time to make big profits on shoestring investments

By HERBERT SHULDINER

A Portales, N.M., civil servant leaves his office every evening, but his real day is just beginning. To change from the daily routine, he goes down to his basement shop and starts sharpening lawnmower blades and re-toothing saws on two inexpensive machines. His annual income from this leisure-time activity is more than $2,000.

After a day of ministering to the sick, a Chicago hospital employee spends his free time at a laminating press, making unusual gift items—and earns about $100 weekly.

A father-son team started with one rug-cleaning machine several years ago and built up a business that brings in over $30,000 annually.

These are just some of the thousands of people who like to work with their hands who have found a satisfying sideline that can often be expanded into a profitable full-time business.

It takes hard work and a willingness to use some of your leisure time. But surprisingly, you don't have to save thousands of dollars to start a small business of your own. Some enterprises can be launched for under $100, many others for under $500.

You can choose from inexpensive machines that perform such sought-after

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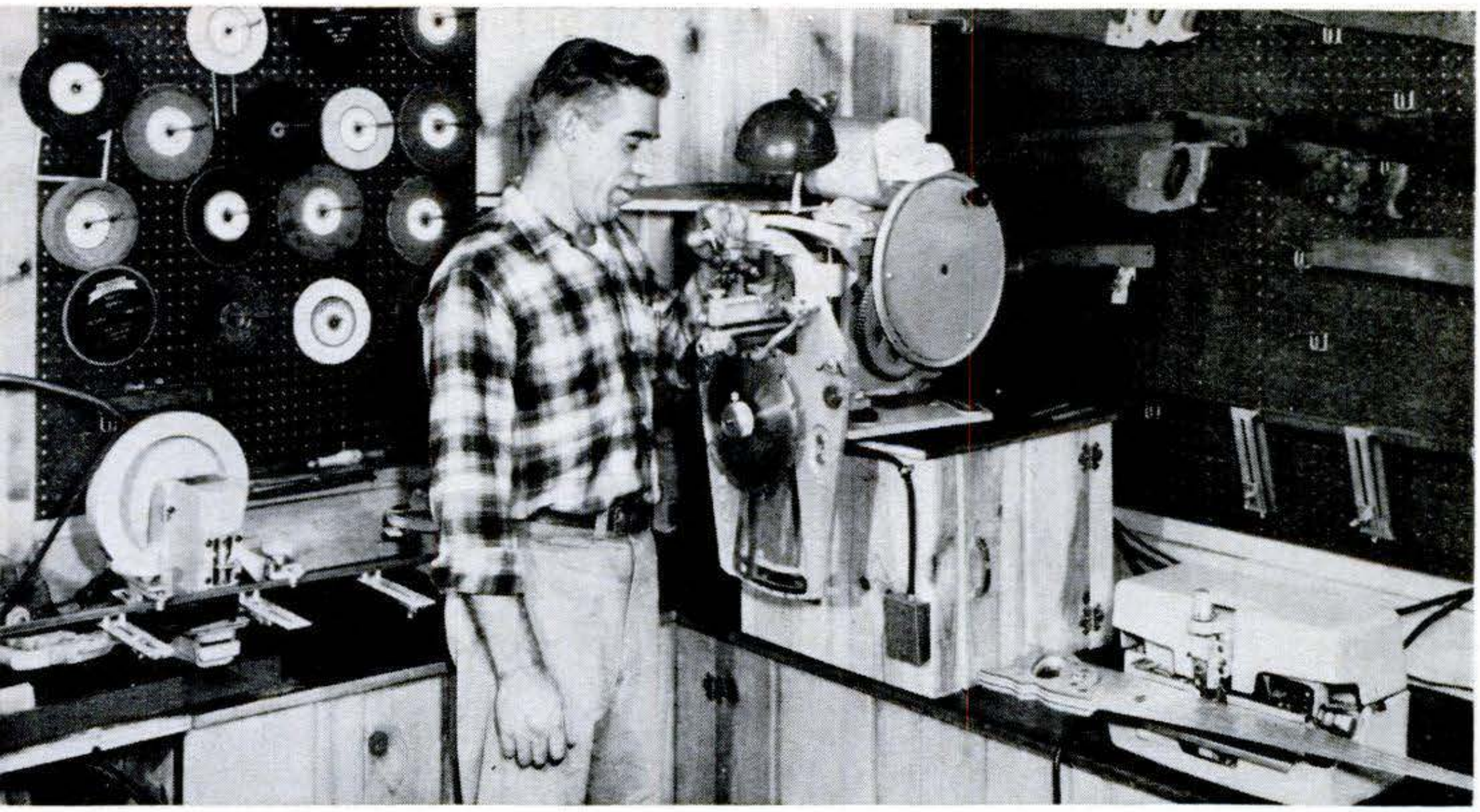

An entire saw-repair shop can be set up in a corner of your basement. The man in the photo above has an assortment of Foley saw-sharpening equipment, which the company says can gross from six to 10 dollars an hour—90 percent of it profit. The equipment is installed on an ordinary bench and includes an automatic saw filer (center), a power setter (right), and a re-toother (left). The automatic filer does both handsaws and circular saws like the one shown in the machine. The power-setter unit resets saw teeth in proper position, bringing them to the right angle prior to being sharpened. The re-toother cuts full sets of new teeth—both rip and crosscut. The entire outfit costs about $700 and can be bought for a 10-percent down payment; the balance can be paid off in two years.

Money for You

services as opening clogged drains and plumbing, machining small parts and moldings, sharpening and re-toothing saws, key making, and a variety of home-cleaning services.

These machines do their jobs quickly and well. How much income you will take in from your labor depends on how much time you invest.

Here's a survey of some of these machines and companies that make them:

Sewer and drain cleaners. Powered, but lightweight, these machines use spinning knives to clean out drains, mains, sinks, toilets, and other clogged fixtures. The Miller Sewer Rod Co. of Chicago, a leading maker of these rotating blades, estimates it takes about $800 to $900 in equipment to provide a fairly complete service in this field. But check out local ordinances for licensing requirements before buying these devices.

Tool sharpeners: Everyone, from housewives with dull-bladed knives and home-workshop handymen with dull power-saw blades to big companies that use high-speed router bits, is a potential customer for the man with the right sharpening equipment. The Holst Mfg. Co. of Torrance, Calif., offers a circular-saw-blade sharpener for as little as $60. The Belsaw Machinery Co. of Kansas City, Mo., and the Foley Mfg. Co. of Minneapolis are two leading companies in this field and offer complete sharpening kits that can handle anything from simple handyman tools to complex industrial equipment.

Home-cleaning devices. There's a booming market for rug, upholstery, and wall-cleaning services today. You can do this work right in the customer's home with easy-to-use machines. Start out by buy-

Continued

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You can use the profits from one machine to buy others

Wall cleaning is an easy and profitable service with the von Schrader wall deterger. The $350 device automatically cleans a wall with a special detergent that is forced out through a hose under pressure. You can earn as much as $300 a month working in your spare time, but the company says some full-time wall cleaners earn about three times that amount.

An investment of about $400 for molds will start you in the profitable business of making attractive garden ornaments like the urn above. Easy-to-handle aluminum molds like these, made by the Concrete Machinery Co., Hickory, N. C., allow you to make a swan or a large pot for about 75 cents' worth of materials. You can sell these items for from $2 up to $10, depending on prevailing prices in your area and the quality of your workmanship.

ing one type of cleaner, then expand on the profits you make. Francis von Schrader, whose company in Racine, Wis., has placed about 40,000 men in this business, says that about 60 percent start on a part-time basis. About 90 percent wind up with more than one of the three machines his company makes, and some 70 percent eventually go in full-time.

Laminating and electroplating machines. It's easy to permanently preserve mementos and important papers nowadays with inexpensive machines you can use in your own home. There's a steady demand for bronzing baby shoes, which can be done with a simple electroplating machine. Laminating presses not only preserve, but can be used to make clever decorations and novelties, according to the Warner Electric Co. of Chicago, which markets these machines.

Printing and engraving presses. There's a large demand today for engraved, laminated plastic signs and rubber stamps. The Scott Machine Dev. Corp. of Walton, N.Y. says you can make a $1 laminated sign from 10 cents' worth of material. The Scott kit for this process costs about $140.

The Custom Printers Supply Co. of Springfield, Mo., says it can start you in the rubber-stamp business for about $170. This buys a five-by-eight-inch platen press that can make three-line rubber stamps that sell for about $2. Your cost—about 15 cents' worth of materials.

You can also cash in with automatic machines that make custom moldings and specialty woodwork. The Belsaw Machinery Co. offers a machine that will put you in this business for about $500.

Although these machines are easy to acquire and use, there's nothing automatic about succeeding in business. Here are a few things to keep in mind:

Don't enter a field that's already adequately filled in your community. If you rent a store, get one in an area with plenty of traffic going by.

Learn to estimate what your labor and materials cost, so that you can earn a fair profit. And remember, your success depends upon your ability to sell yourself as well as your services. PS

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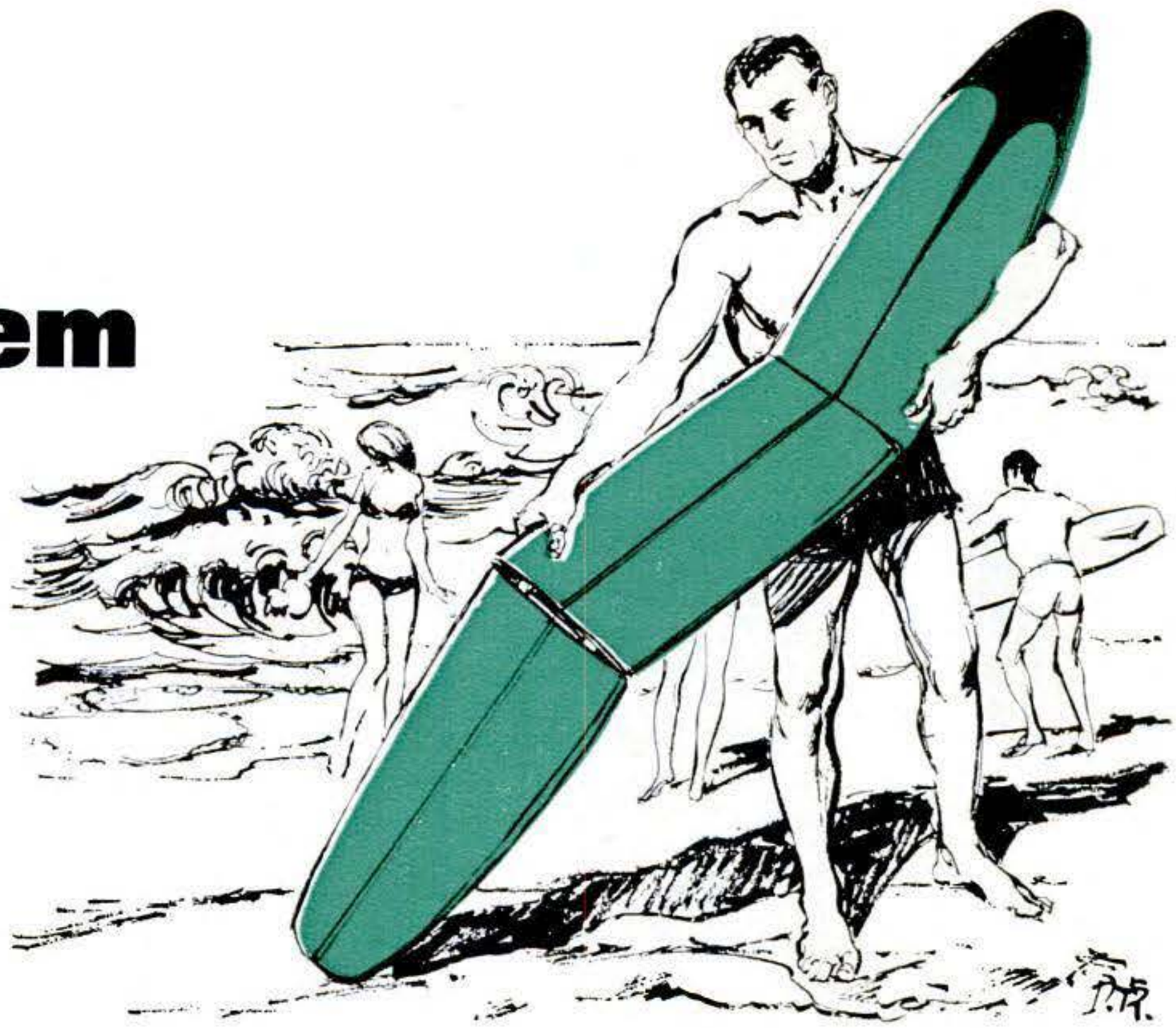
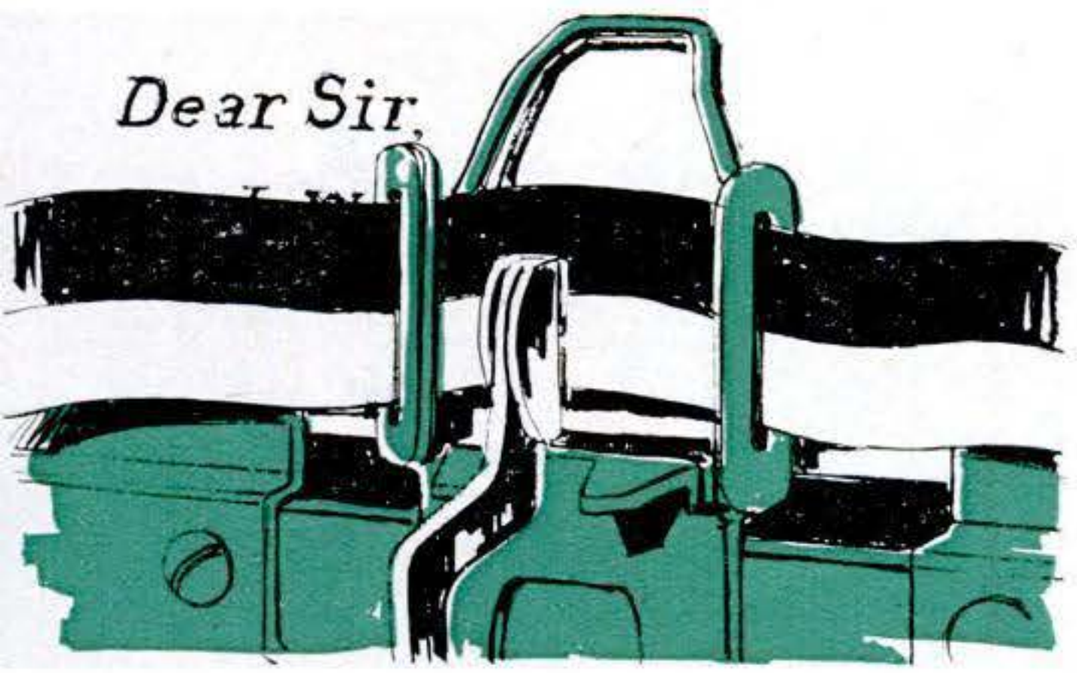
"I'd like to see them make..."

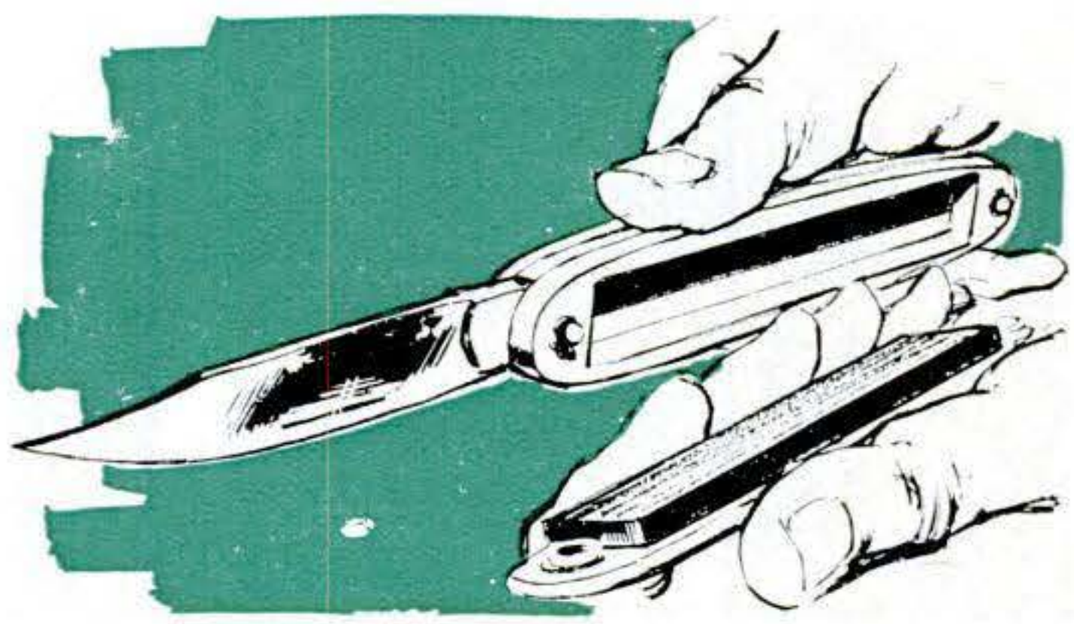
DRAWINGS BY DANA RASMUSSEN



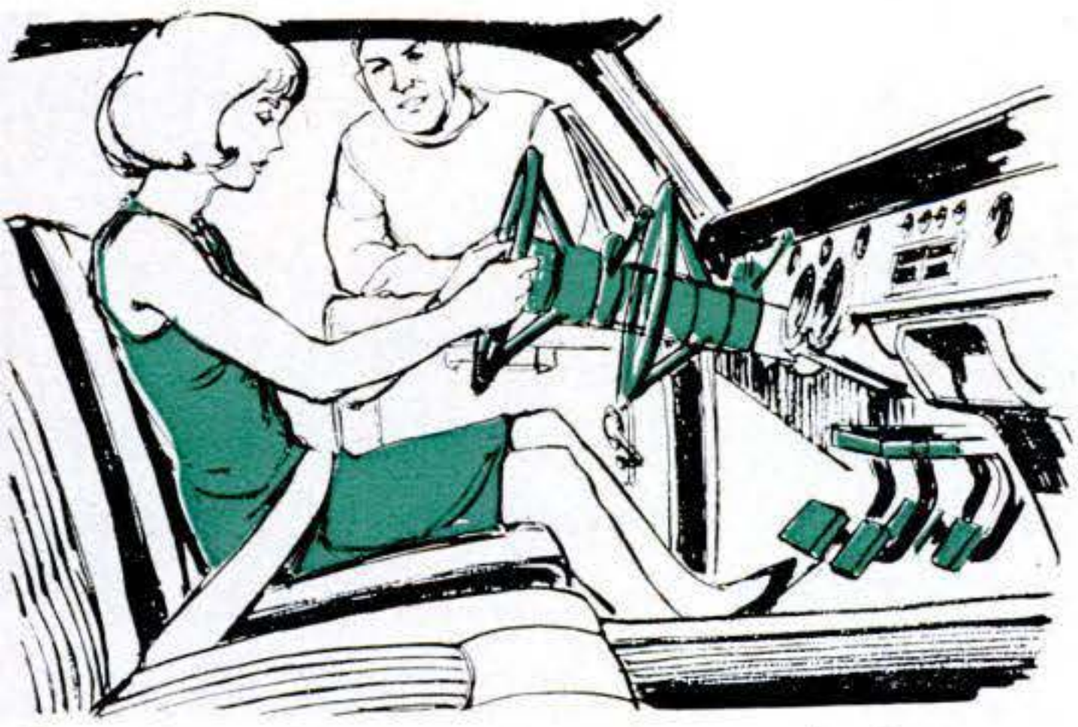
Fold-up surfboards with latches to lock and hold them together. Then you could carry them inside a car and store them easily in the winter.—*Bill Woodward Jr., Alexandria, La.*



Black-and-white typewriter ribbons—the white half chemically coated like "erasing" tape. Corrections could be made with a flip of a lever.—*W. A. DeLashmutt, LaGrande, Ore.*



Sportsmen's jackknives with their own honing stone. To eliminate need for a screwdriver, the fasteners should be removable with a dime.—*David Funk, Marblehead, Mass.*



Cars that adjust to driver size—a six-foot man or his tiny wife. The seat would be stationary; you'd move steering wheel and pedals fore and aft.—*John Norbert, NYC.*

Rifle slings fitted with pockets for ammunition, like webbed ammo belts. Slipping out cartridges would be easier than fumbling in a pocket.—*David Hamann, Luverne, Minn.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 10017. Write your name and address clearly. Contributions cannot be acknowledged or returned.

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Your senses an
useless. As yo
float in a tank o
body-temperatur
water for science
your world is the siz
of your face masl
Then panic strikes..

I spent 90 minutes in hell:

NOTHING

to see...to feel...to touch ...to hear...to taste

By ROBERT GANNON
ILLUSTRATION BY GIL COHEN

The hookup took 31 minutes. At 10:29 a.m., wires dangling from my arms, chest, and head like marionette strings, I was led to the dungeon-like, soundproof barrel room. The temperature was 102 degrees, and sweat began running down my body.

In the center of the 15-foot-square chamber squatted a giant, 3,400-gallon wooden barrel, eight feet high and nine feet across. A wooden stairway – somehow reminding me of gallows steps–led up the side of the tank to a platform.

The water seemed hot, like too-hot bath water. Dr. Wayne Patterson, my physiologist-guide, checked it: 96 degrees, about skin temperature. Just right. He plugged me into a jack box and looped a loose belt around my chest.

How much can man take? I was one of the first subjects in a new study of the effects of isolation, a project sponsored by NASA, designed to find out just what happens to a man when he is "de-patterned" – cut off as completely as possible from his normal environment, his senses largely blocked or misled.

"There's going to be isolation in any space flight in the foreseeable future," says Dr. Donald Forgays, chairman of the University of Vermont psychology department and director of the project. "Payloads on these vehicles will be such that astronauts will have little free movement. They'll find much that is unfamiliar; they'll experience extensive de-patterning."

One way to find out what might happen: Take a man and cut off all the sensory information he usually relies on to keep sane–sight, gravity, sound, the feel of air brushing his skin. Float him in a warm-water barrel in the dark and leave him there. Watch what happens to his body and his mind. See how much he can take, and what manner of man it is who can last the longest.

For the full time I would be underwater, Dr. Patterson would record my

Continued

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reactions. Four squiggly lines would show my electrocardiogram, respiration, eye movements, galvanic skin response, and electroencephalogram, or brain waves.

"Occasionally our subjects hallucinate," explained Dr. Patterson. "If you do, maybe we'll be tipped off. Remember, you can leave at any time; just let us know and we'll get you out in half a minute. Report anything interesting that occurs—we'll hear you."

Diving in the dark. He adjusted the mask straps for my head. The mask is the full-face, skindiving type except that it's blacked out so you can't see. A diver's mike and loudspeaker are built in. It was 10:41. Blackness. Complete. The sound of operating-room deep breathing. The smell of air-hose rubber. A slight tinge of claustrophobia, of not enough air.

I felt my way down a ladder into the warm water; it closed over me, and suddenly I was alone, bobbing in space.

My body assumed a face-down position, hunched forward at the waist. Immediately under the mask, my nose developed a maddening itch. I talked to myself, recording my feelings. "A curious bubbling sound seems to be coming from my left ear. I'd just as soon it wouldn't. My face has a burning feeling, and my mask is pressing my forehead and chin too hard. I feel my fingers puckering. All my limbs seem heavy and going to sleep."

I estimated that a half-hour had passed. Despite my general comfort and fascination with the experiment I was unhappy. I began to complain to no one in particular. "My mask is too tight," I said. "I'm going to try to relieve it with the blowout." A button on the side of the mask allows air to rush through. I pushed it, and it helped my chin a little.

My face was sweating under the mask, and perspiration had run down to lie in a puddle at my chin. I pushed the air knob to blow it out, but the air scudded past my ears instead of my chin. Air continued to whoosh past my ears, and I lifted the chin strap with one hand. Suddenly water slurped into the mask, rising over my chin and running into my mouth. Panicky, I held the mask tight at the sides and slammed the blowout again. The water squirted out, and I relaxed.

Electrodes are taped to Gannon's head, hands, back, and face to monitor his stress during isolation.

The feel of nothingness. Another half-hour passed, and I reported that the face mask was making my head sore and I was getting a headache.

I was becoming bored and irritated. I wiggled my toes to see if I could feel them. They were there, all right, but I wasn't convinced they, or even my chest, were really a part of me. My whole world had shrunk to the size of my face mask. My ears seemed to be inside the mask, too, though I remembered they really weren't.

I realized that I didn't know which way was up (others have reported tumbling or spinning while actually motionless).

I tried to get my mind on something—anything—and tried to visualize a room in a house that I am fixing up. I quickly lost interest, and began to focus on the feel of the face mask, the sound of bubbles, the rhythm of breathing.

In a last-ditch effort, I tried to think of women—in general, then specific. No luck. I seemed to loll, nearly mindless.

"I'm seeing something," I announced

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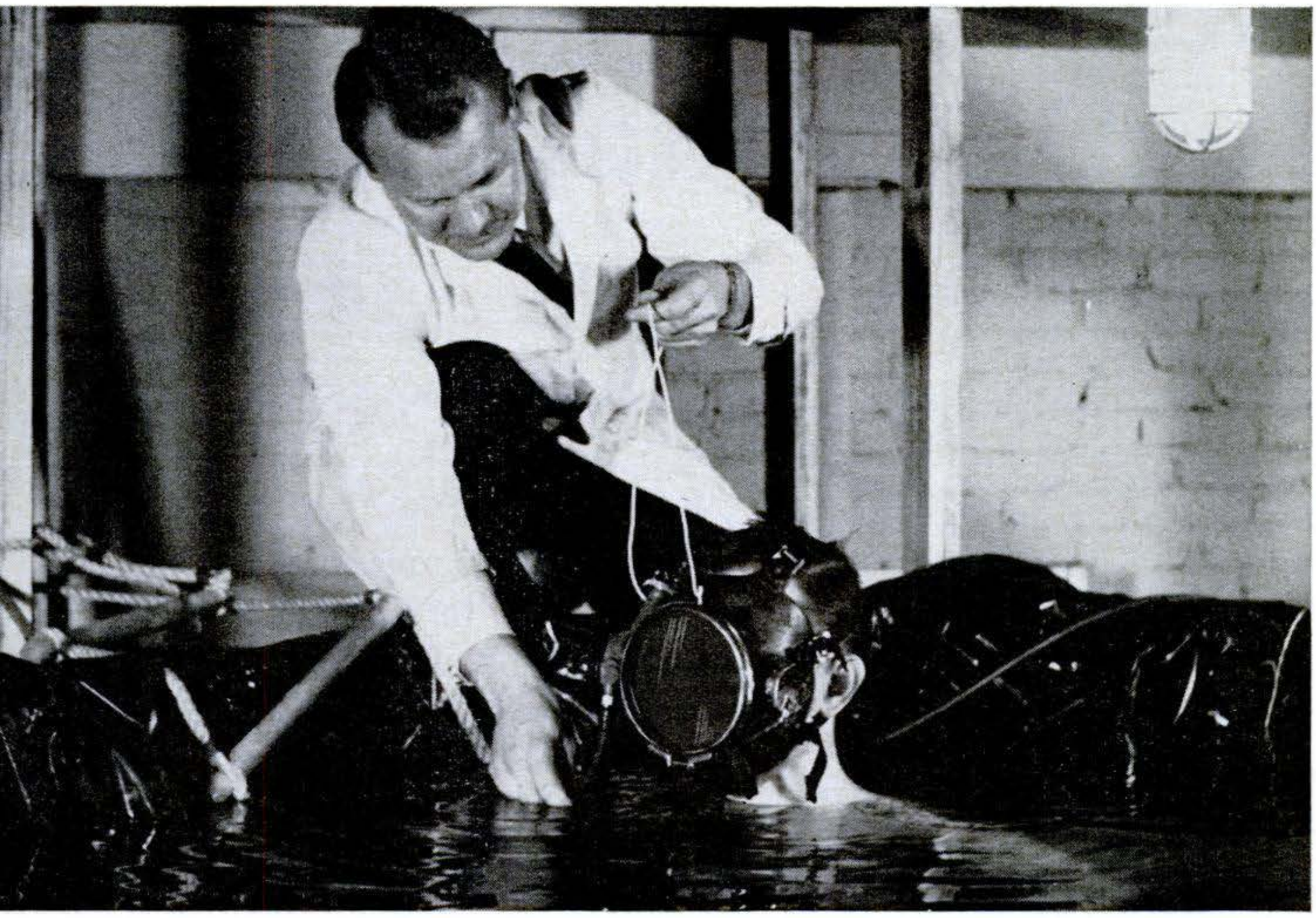
hallucinations, fear—all begin where the senses leave off



Suspended in a tank of body-temperature water with face mask blacked out, Gannon undergoes sensory deprivation—lack of normal sight, sound, touch. Experiments will aid astronauts on long missions.

a bit later. "Navy-blue smoke, thick and stirring." Then, still later: "Another flash —a sunset in black and white."

The hours passed, two or three of them I guessed. My headache kept jarring and then I began to feel nauseated. I found myself jiggling my arms and rubbing my fingers together and stretching, wishing I could press against something just to find a sensation I could recognize. I was very, very tired of what Forgays calls "absence of sensory input." (It was about this time that I began to groan and mumble, a tape recording reveals.)

Then nausea waved over me again, and I visualized throwing up in my mask. That clinched it. "I want out," I said in a shaky voice.

Shortly thereafter I felt a hand on my arm, and with a tremendous effort of will I paddled over to the ladder and laboriously, working waterlogged muscles, dizzily hauled myself out. Somehow the sight of the room astonished me. My eyesight seemed more acute, and details stood out so clearly they seemed unreal.

The sound of something other than air bubbles was pure joy.

Results of an experiment. What had happened to me down there in the dark? Dr. Forgays' tracings showed my eyes were shifting constantly at the last, tracking imaginary objects. My heartbeat increased from a placid 76 to an agitated 98. Emotions, shown by galvanic skin response, began smoothly, then swung wildly.

Then came the surprise. "By the way," Dr. Forgays told me, "you estimated you were in the tank for 2½ hours. Well, you broke a record—you gave the worst time estimate we've ever received. Actually, you lasted just 90 minutes." PS

Do you have an idea for Bob Gannon?

Bob Gannon, PS go-anywhere, do-anything reporter, likes to do the highly unusual. If there's something you'd like to do but can't, or would like to see someone else do, write to Bob Gannon in care of Popular Science, 355 Lexington Ave., New York, N.Y. 10017.

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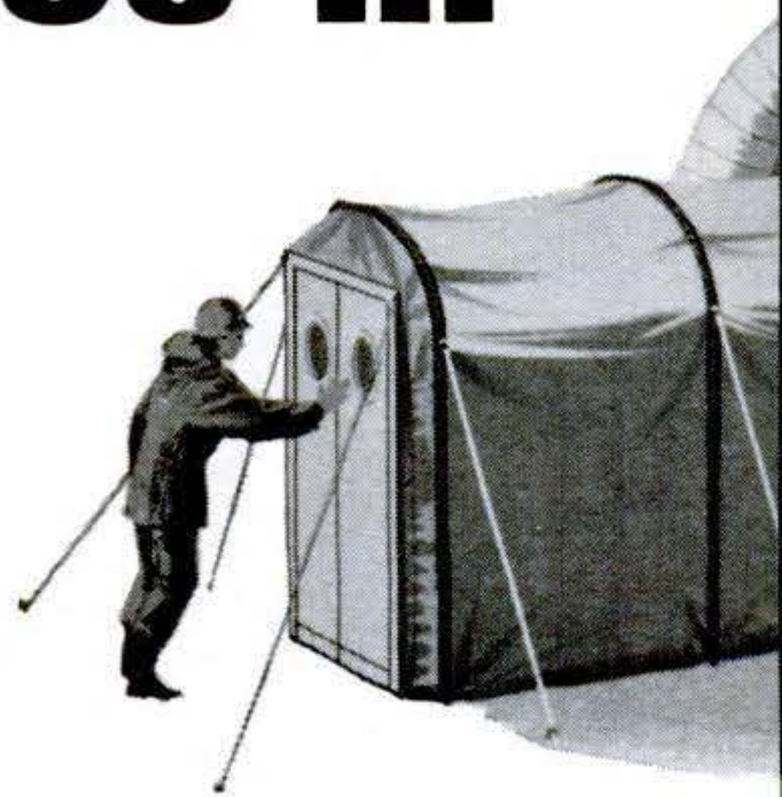
Medical Miracles in South Vietnam



Helicopter ambulances, battery X-ray machines, mobile hospitals, and a 46-pound laboratory are among the remarkable medical tools that are saving the lives of our fighting men

Part of new inflatable hospital is this rigid aluminum-faced, plastic-foam operating room transportable by truck or chopper.

By JAMES H. WINCHESTER

Specialist Fourth Class Wallace Tao of the 173rd Airborne Infantry was brought into the Army's tent hospital in the jungle out beyond Bien Hoa just 50 minutes after he was wounded by Vietcong mortar fire. In deep shock and bleeding internally, the young soldier was just about as close to being dead as a man can get.

"Let's operate right now," ordered Major Peter Downs, a surgeon.

Sweat poured off his forehead in the better than 100-degree heat, but his skilled hands never wavered. The diaphragm, which is the wall between the chest and abdomen, was lanced. A mortar fragment had passed through the spleen, in and out of the stomach, and through the left lobe of the liver. On its jagged way it had lacerated the artery that supplies blood to the diaphragm, and torn the gullet, which is the tube running from the throat to the stomach. Another piece of metal rested in the chest immediately below the heart. Slowly, carefully, it was removed.

The spleen was taken out and the bleeding stopped. Major Downs clamped and tied off the torn artery, removed the damaged portion of the left lower lobe of the lung, repaired two holes in the stomach wall, and sewed up the gullet.

Cutting fatalities. In any other war, Tao would almost certainly have died. He was in the operating tent more than four hours. He received 22 pints of whole blood. Yet within a week he was well enough to be flown to Tripler Army Hospital in Honolulu for final recovery.

New and improved medical tools, techniques, training, and medicines give our wounded in Vietnam a 2½-times better chance to live than those in Korea. Just

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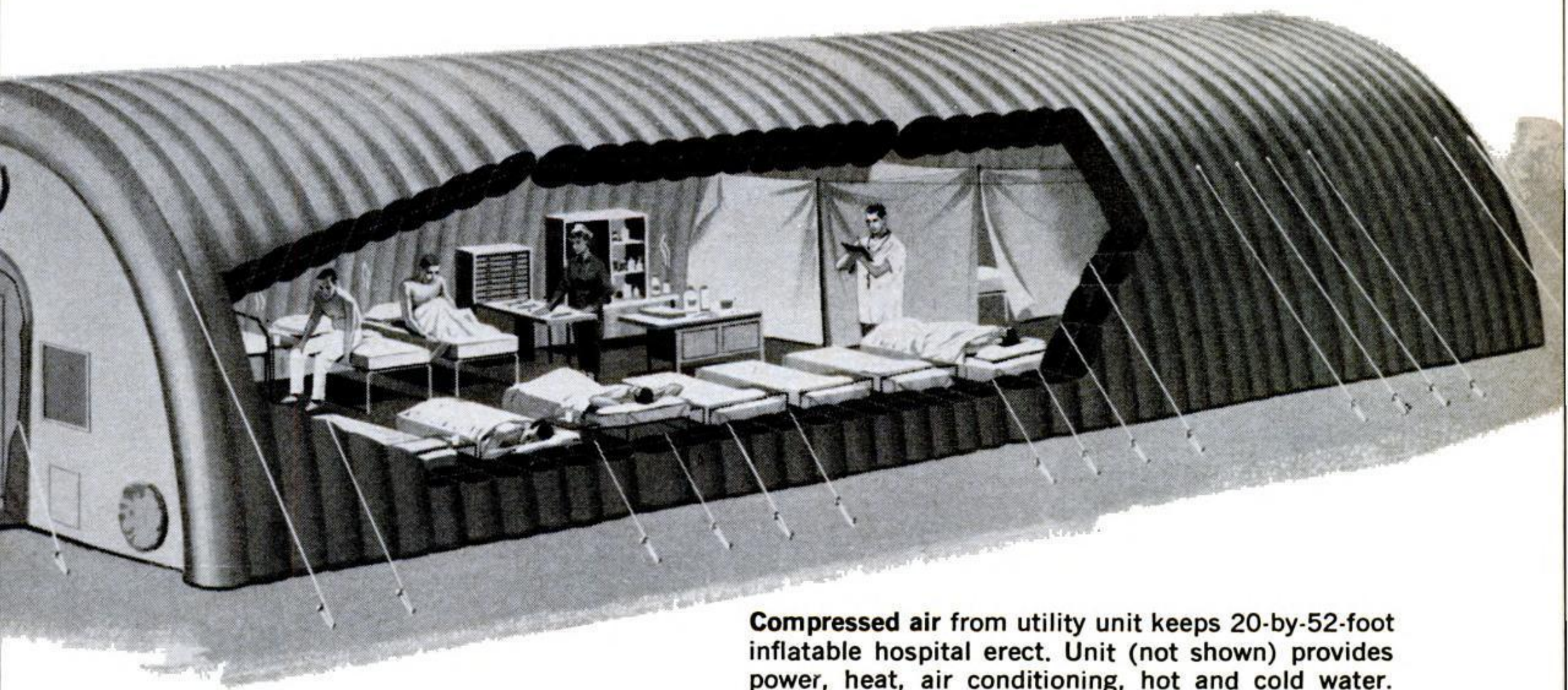

Compressed air from utility unit keeps 20-by-52-foot inflatable hospital erect. Unit (not shown) provides power, heat, air conditioning, hot and cold water.

over one percent of all U.S. soldiers injured by the enemy in Vietnam die. In Korea, the rate was 2.5 percent; in World War II, 4.5 percent; in World War I, eight percent.

Many devices contribute to this battlefield survival. I saw them in use at the Army's Third Army Surgical Hospital, a mobile tent-housed unit in the jungle of the Iron Triangle between Saigon and the Cambodian border.

A medical helicopter lands. Corpsmen run out to meet it. Three badly wounded infantrymen are lifted out. The rotor still spins above their heads. Their litters are pushed to the preoperating tent. Above them, corpsmen string bottles of dextran, the now commonly used substitute for blood plasma, with their trailing tubes.

The X-ray tent is 100 steps away. Litter patients are lined up outside, intravenous bottles hand-held above their heads. The wait is short. The Army's new portable, self-contained battery-powered X-ray machine, with Polaroid film processor, speeds the work.

Suitcase X-ray. This 83-pound unit, just developed, does everything that a standard ton-and-a-half X-ray machine can do. A 10-cell, 20-volt silver-cadmium storage battery powers 200 chest X-rays without recharging. Inside the compact transistorized unit is a built-in battery charger and inverter to change the DC battery voltage to AC.

A round black cylinder mounted on a stand contains the X-ray tube along with a transformer to step up 110 volts to 120,000. The high-voltage, low-current tube uses relatively little power and reduces the radiation to a level where no shielding is needed for the operator.

The pictures are taken quickly. Processing is even faster, in a Polaroid unit that consists of two pressurized rubber rollers driven by a spring motor. A corpsman puts an exposed 10-by-12-inch Polaroid X-ray film packet into the unit. Ten seconds later he has a positive-print X-ray which may be viewed directly.

Next door is the open-ended, open-sided operating tent. A wounded sergeant's

Continued

Instant X-rays in the field are taken with battery X-ray machine on specially designed Polaroid film. The film produces a positive print, eliminating the need for a viewer. Newly developed canvas litters hold patients in position for fast X-raying followed by 10-second film processing. Machine can make 200 exposures without a recharge.

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litter is transferred, and I follow him.

This front-line operating room has a bare wooden floor. Dust, outside and in, is always there. Yet the surgeons have dry, sterile dressings and instruments. They come from an ultralightweight autoclave a foot square, heated to 250 degrees by a tiny steam generator. It is running on electricity, but can be fired from any power source, including an open wood fire.

The Army surgeon stands at the end of the sergeant's litter. A pint of whole blood drips life into the wounded man's veins from a plastic sack taped to one of the tent's wooden poles.

Successful tests of frozen blood have just been completed in Vietnam. In a new transfusion technique, frozen blood is kept at a temperature of 80 degrees below zero by packing it in dry ice. It can be stored for at least two years. Conventionally stored whole blood isn't considered safe for more than 21 days.

Also new are the two small test tubes, one with a sample of red cells and the other with a sample of blood serum, fastened to the outside of each plastic container of whole blood. This allows blood to be quickly matched on the battlefield to that of wounded GIs.

The surgeon makes a 14-inch-long incision into the sergeant's red-stained stomach. The intestines are lifted completely out of the body, explored for damage. The left lobe of the liver has a three-inch laceration. It's closed and drained. The part where a quarter-inch piece of rusty metal from the exploding land mine tore through the abdominal wall is cut out.

A hole in the sergeant's chest bleeds lightly. The surgeon makes a deep, six-inch-long cut left of the breast bone. Inside, the big mammary artery, running up and down through the chest, is completely severed. The bleeding is heavy. The lung is punctured. The artery is tied off.

The tube from a battery-powered suction pump is inserted in the lung to draw out air and blood. Designed for Vietnam, it is made largely of plastic to avoid breakage, reduce weight. Its motor and switches are sealed in an explosionproof housing so a spark won't set off the anesthetic-loaded air.

One hour and thirty-six minutes have passed since the operation started, but there's still plenty to do. Two surgeons work, one on the leg and foot, the other on the left wrist. Huge holes in the thigh go down to the bone, which shows starkly white through the blood. The left instep is shattered. In the left wrist the ulnar nerve and artery are both cut in two. The artery is tied off. Muscle is cut away and cleaned. Holes are left open against infection.

Major blood vessels are being repaired in the field. Surgeons use synthetic tubes to replace arteries torn by shrapnel. Antibiotics, many of which were unknown in Korea, are a big factor in reducing infections. A sulfa compound in a creamy base cuts in half deaths of men burned over as much as two-thirds of their bodies.

"I think we've won the battle," says a surgeon looking up.

A 46-pound laboratory. Many more medical tools are being proved for the first time in Vietnam.

Basic diagnostic procedures are performed right in the field with a portable miniature 46-pound laboratory. A medic straps the lab kit to his chest when he parachutes into the jungle. It has tools for making blood counts, smear and fungus examinations, and many other tests. There's even a high-power microscope.

A complete laboratory, with the materials and instruments to make tests equivalent to those performed in large hospital and commercial labs, is contained in the small backpack carried by medic.

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Airmen in Vietnam carry a small drugstore with them on every mission. The lifesaving package, tucked away in the left side pocket of the flyer's survival vest, contains tablets for fever, infection, diarrhea, fatigue, headaches, pain, malaria, fungus, water purification, insect bites, and eye irritation, among other things. There's a razor blade and holder, bandages and elastic, gauze, a mosquito head net and mittens, a compass, and a flexible saw for cutting wood and metal.

The inflatable hospital. When the Army's first portable, inflatable, instant hospital, the only one of its kind in the world, went into battle late in 1966, it was badly mauled by enemy mortar attacks and gunfire. Repairs were made swiftly. Within two hours the surgical team of the $2-million hospital had performed four major operations.

The joint brainchild of the Army Medical Service and the AiResearch Division of the Garrett Corp., MUST (Medical Unit Self-Contained, Transportable) can be flown by plane or copter, or be trucked to any location. Its fabric sections zip together and are inflated from a utility pack containing a gas-turbine engine. Burning almost any fuel, the turbine also generates electricity for lighting, air conditioning, and hot water.

The air-supported structure—which can withstand hurricane winds and comes equipped with a patching kit to make repairs—can be made into 20-bed wards, an air-conditioned operating room, and laboratories. Each of the pressurized units has its own airlocks for doors and any number can be put together to make up to a 400-bed hospital.

Equipment and supplies for MUST are prepackaged, ready for immediate use. If necessary, everything can be collapsed and loaded onto trucks or helicopters in less than 15 minutes.

Yet another type of mobile hospital is an aluminum-alloy pod weighing two tons and measuring 30 by eight by 11 feet, carried slung beneath a CH-54 Flying Crane helicopter. It can hold 14 people and four surgical operations can be performed at one time. It is air-conditioned, has hot and cold running water, adequate lighting, and a full stock of surgical tools, necessary drugs and medicines.

Battery-powered microscope, foreground, is included in lightweight lab. There are also a 2,400-r.p.m. lightweight centrifuge, chemicals, test strips, refractometer, vessels, and other equipment.

Hospital ships. Much more sophisticated gear of all types is aboard the U.S. Navy's hospital ships, which operate off Vietnam's coast, just a short helicopter hop from the fighting. Huge red crosses are painted on the sides of their stark, white hulls, and they are brightly lit at night, visible for miles. Each is staffed by 30 doctors, 30 nurses, and 246 corpsmen.

Everything is air-conditioned. The medical equipment is better than that in most U.S. civilian hospitals. The Repose, for instance, has two portable heart-lung machines weighing only 50 pounds each. They are flown ashore in helicopters if they're needed.

Open-heart surgery is performed aboard the ships, which also have artificial kidney machines. There are ultrasonic devices for locating shell fragments deep within the body. High-frequency sound waves are sent into the brain and their echoes recorded on an oscilloscope. The image of a buried metal fragment registers in much the same way that a submarine shows up on a ship's sonar screen, eliminating probing operations.

Revolutionary equipment for use in hospitals and in the field is currently undergoing development, much of it at the Army Medical Equipment Develop-

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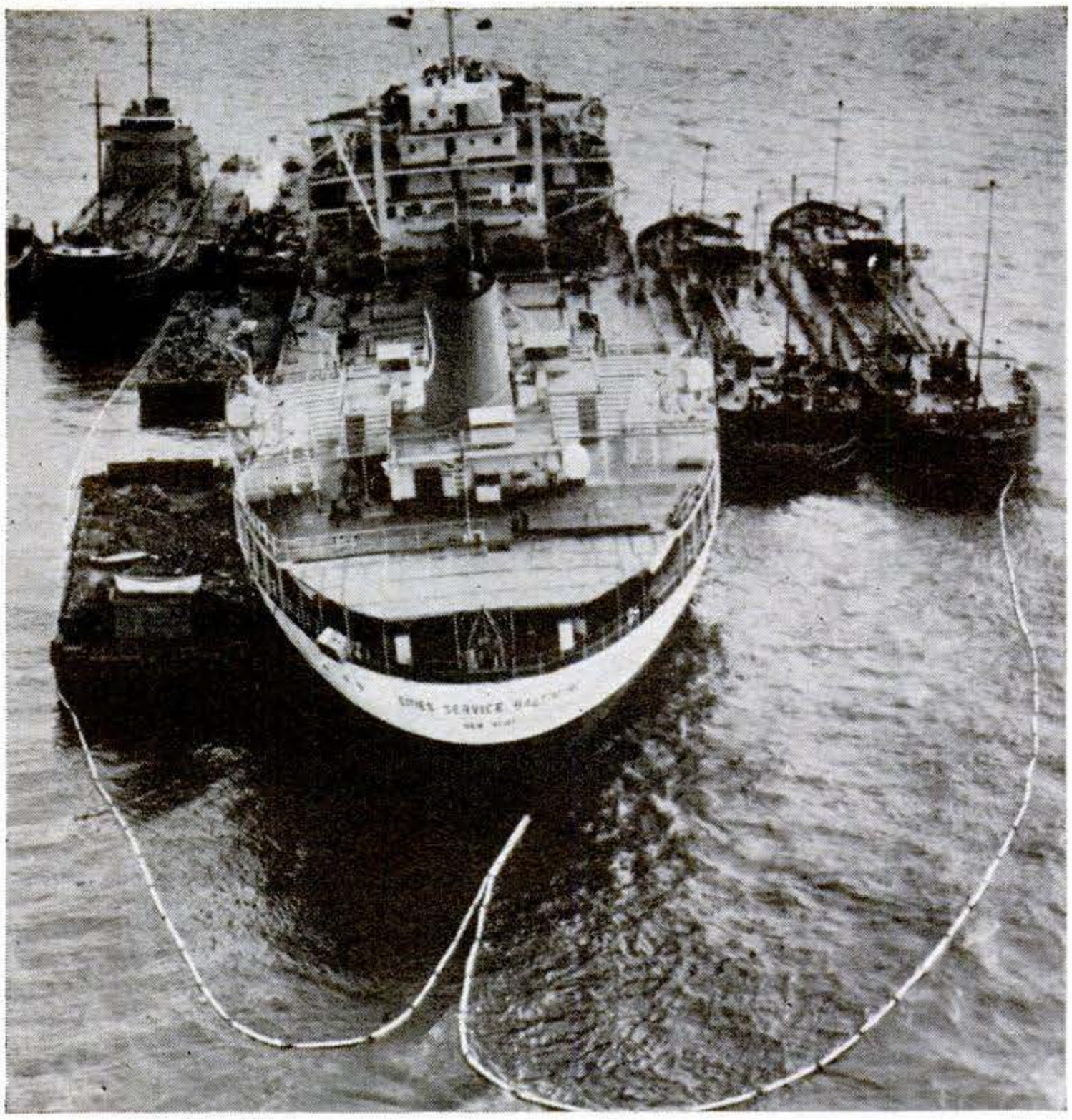
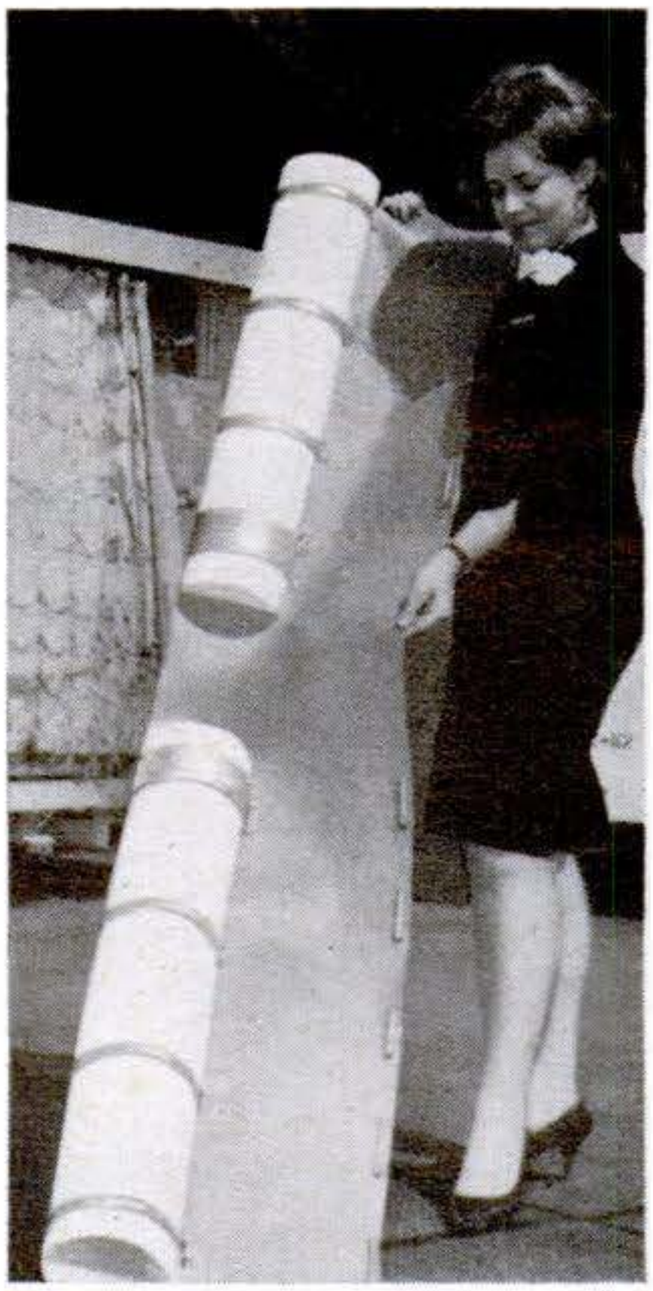
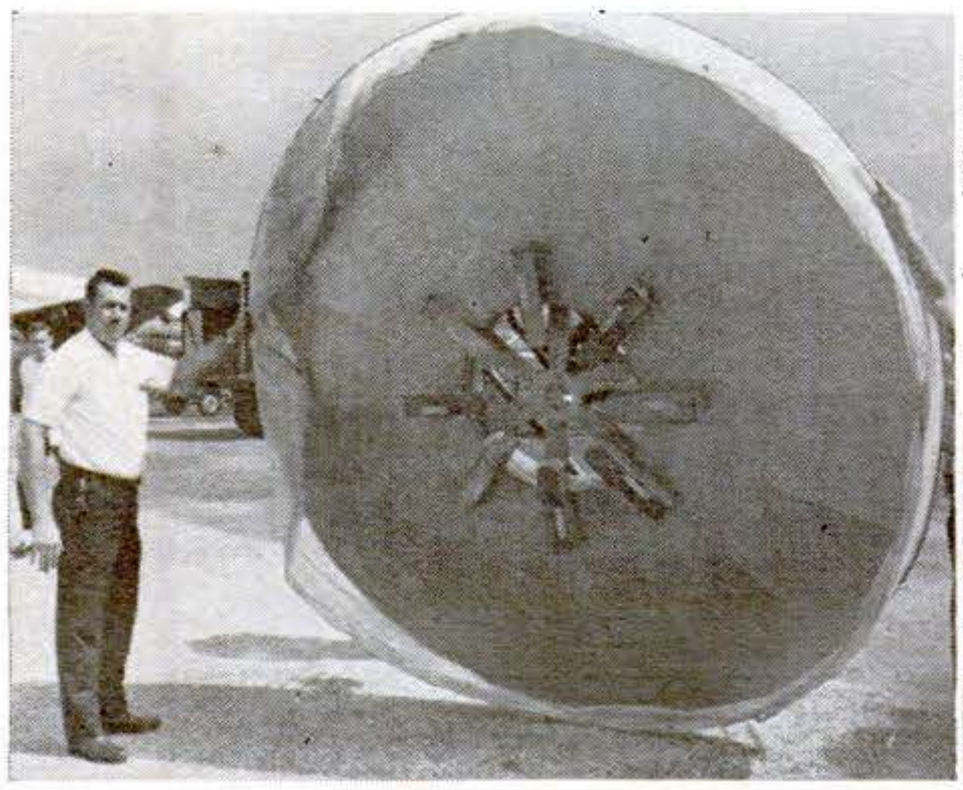




A section of the dam shows its construction. Plastic is held up by a series of cylindrical floats that ride above the water surface. Dam is called Slickbar.

"Dam" holds in oil slicks

The contrivance seen being installed around the stern of the ship above is a polyethylene "dam" floated on water to confine oil slicks, such as those that fouled British beaches when the tanker Torrey Canyon ran aground on a reef recently. Thrown around a leaking tanker, the dam is equally effective in smooth water or wind-roughened waves. One of its chief uses is closing off estuaries. The dam extends 18 inches below the water. Its made by Neirad Industries, Saugatuck, Conn.



Hovercraft is a "flying lawn mower"

Paul Gaither, Miami, Fla., is both an airplane pilot and an engineer. When he decided to build his own hovercraft, he used a five-horsepower lawn-mower engine to drive a six-bladed prop. A plastic skirt traps the air underneath. Movement in any horizontal direction is controlled by body English. The frame is spruce, and the skin stretched muslin. Eight wooden vanes direct the air flow. Gaither says the whole thing cost $94.

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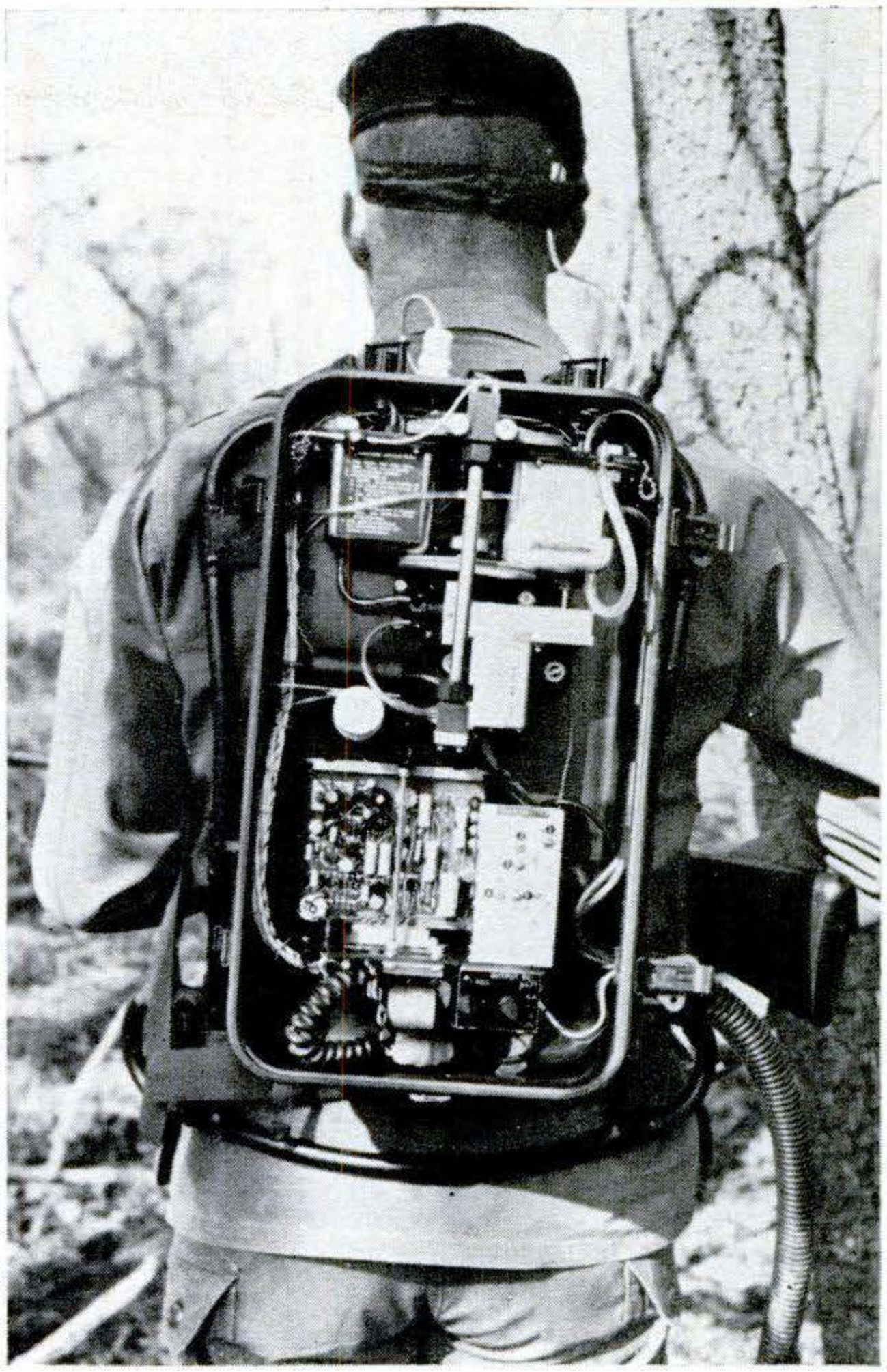
Caution: enemy ahead

One of the biggest problems of U. S. soldiers in Vietnam is detecting an ambush. The Army's Limited War Laboratory at Aberdeen, Md., working with GE, has come up with a "man detector" (picture at right, with cover off). It holds a 23-pound chemical unit powered by batteries, and analyzes "several components of human contamination" in the air. A sniffer on the soldier's rifle collects the odors. When it sniffs a man, it beeps.



Twister—new combat vehicle

The Twister (above) is a five-ton, eight-wheel vehicle with two main body segments joined by a pivot. Made by Lockheed, it has independently suspended front wheels and a rear "walking beam" to let it go anywhere. It can make 65 miles an hour.

New twin-jet airliner tries its wings

Newest of the short-range (100-to-1,300-mile) airliners is this twin-jet Boeing 737. It can carry up to 117 passengers, takes off with full load in four-fifths of a mile, cruises at 580 m.p.h. In contrast to most small commercial jets, this one carries its engines in wing pods, not tail pods. Eighteen airlines have placed orders for 141 of the craft, and deliveries are scheduled to start, Boeing officials say, late this year.

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What would you do? As you start to pass, a car approaches. Only detail exposing scene above as fake

I "Drove" Through a Town

What would you do in a driving crisis? They're finding out in a tiny world you'd swear was real

By W. STEVENSON BACON
PHOTOS BY BILL MORRIS

Did you ever wish you could drive as fast as your car can go? Practice skidding with no danger of an accident? Try passing the car ahead on a tricky, curving road? Make a panic stop at 60 m.p.h.? You can.

Ever wondered what effects coffee, alcohol, or drugs *really* have on your driving? Or perhaps you'd like to know if a driver-training course could do you any good, or if you're as good a driver today as you were 20 years ago. For the first time, it is possible to get answers to these questions.

"Disneyland" for drivers. In fact, that's the purpose of a wonderful test course laid out on the floor of a remodeled factory in Providence, R.I. There the Public Health Service's new Driving Research Laboratory has set up two driving machines built around real cars that—with the help of sound, motion, special optics, and TV—make you swear you are really out on the road.

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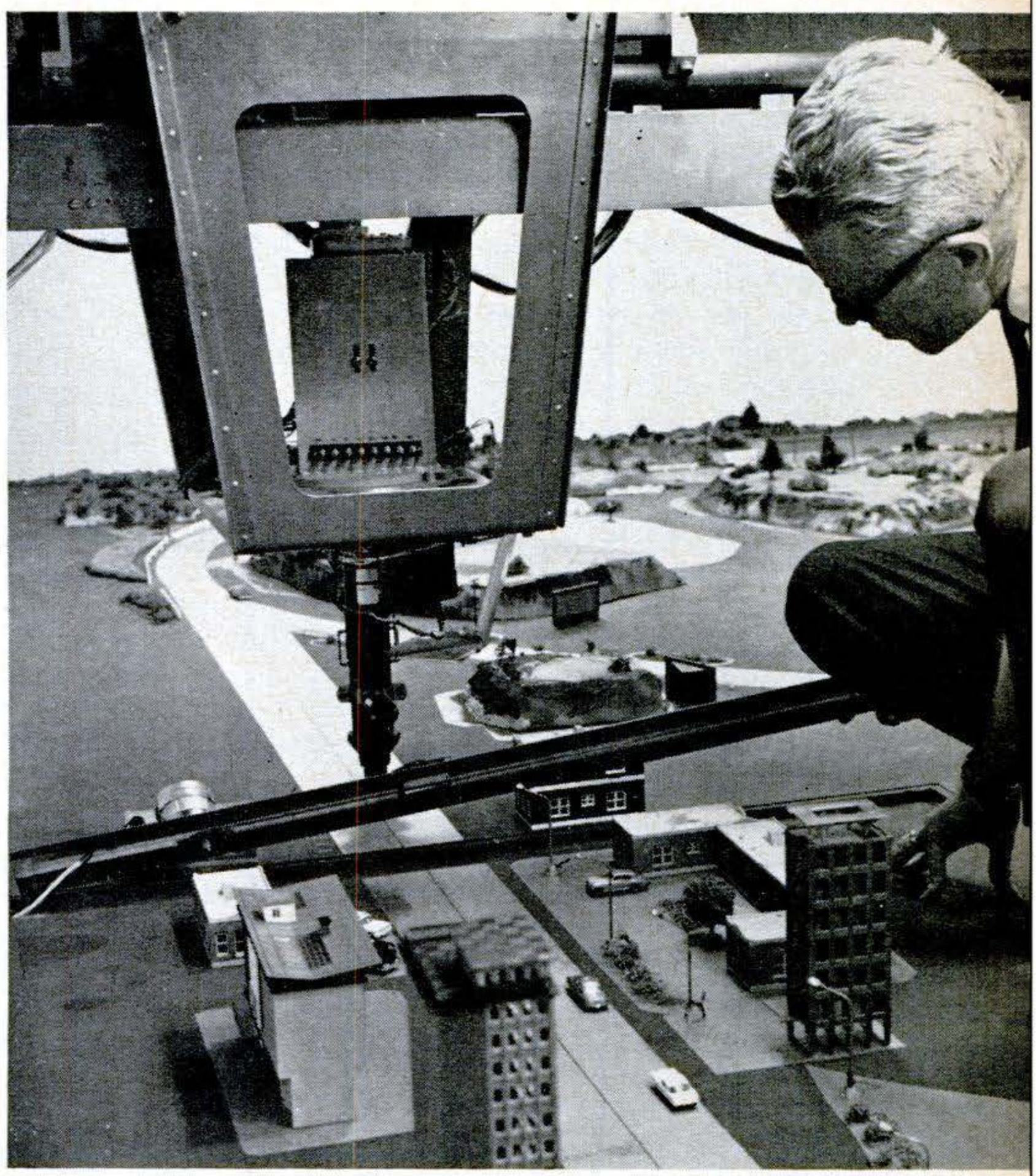
s hard line of distant mountain tops.



Tiny HO-gauge town looks full size to motorized TV camera on gantry. It is laid out around thin plastic roads that lead through business, residential, and rural areas. Mechanism held by operator magnetically shoots car across highway as TV-guided driver approaches.

That Isn't

"We've even had people panic and jump out of the cars," Eugene Pazera told me. Pazera, chief engineer of the laboratory, is a dedicated researcher who delights in his fantastic toys.

"Want to drive?" he asked me as I looked over the Rambler American used in one of the machines—a "belt" simulator.

"Sure," I said, brashly, hopping in.

We were parked on the side of a long, straight "road" with bushes and

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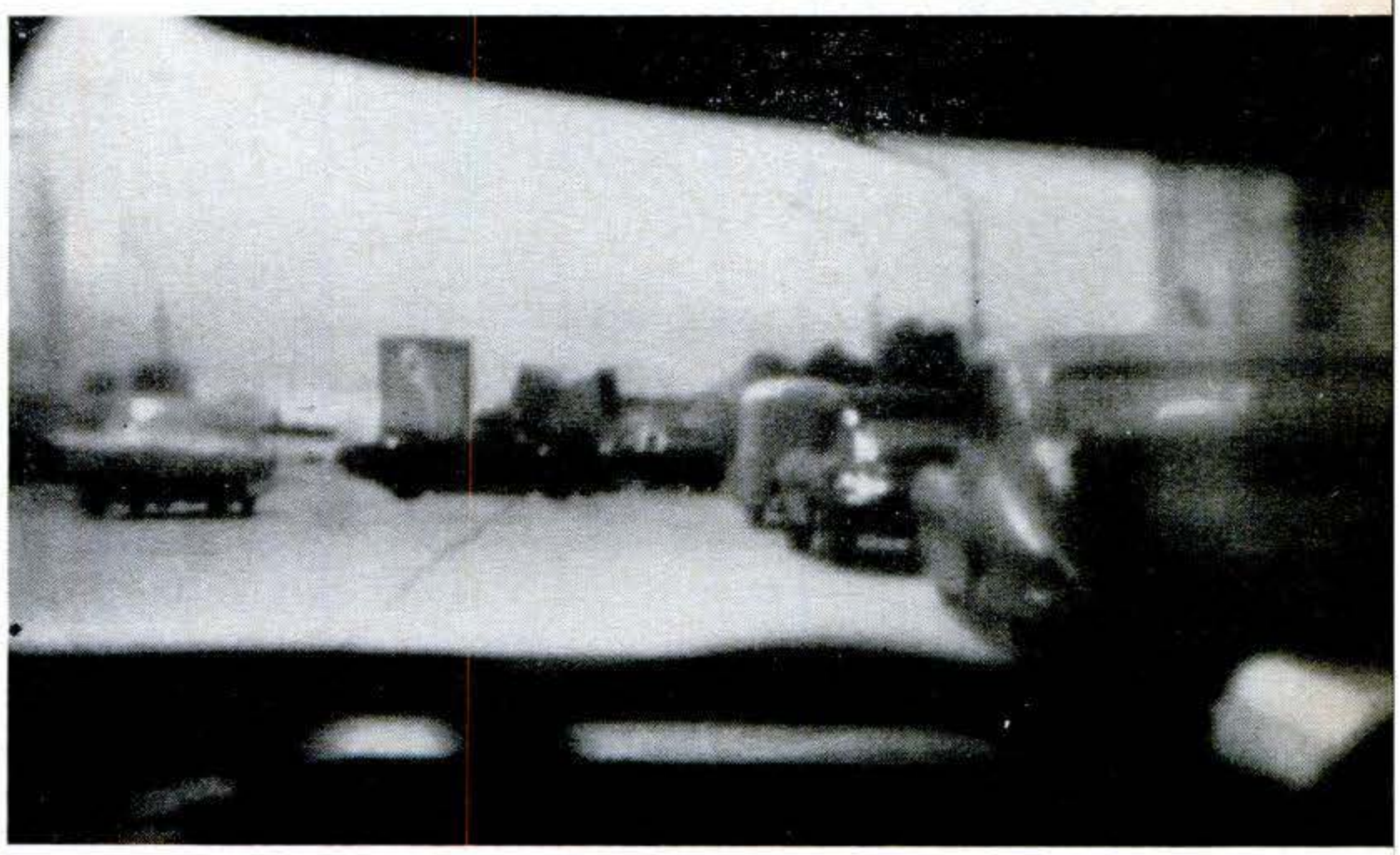

In the TV simulator, the view from the driver's seat looks like this. The model town is so detailed, with trees, lamp posts, signs, traffic, and buildings, that it is thoroughly convincing. The driver has fully proportional control of steering, acceleration, and braking.

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Seated in a real car, you drive in a model town via closed-circuit TV

trees at the sides, off in the distance snow-covered mountains.

"Ready?" he asked. "Shift into Drive and we'll take off."

As we rolled down the road, wind whistled through a window, and the car swayed realistically.

Strange feeling. Not prepared for the elaborate effects, I sat bolt upright, concentrating on staying on the road, forgetting it wasn't real—or was it? "This sure is one strange feeling," I said.

Pazera grinned and said something into an intercom linking the driver and the simulator operator.

Soon I was nearing a car in my lane—I could see his tail lights in the twilight—and I speeded up to pass him. Suddenly, out of nowhere, a car appeared in the opposite lane—I couldn't pass and I veered wildly back behind the car I had been following. He slowed down.

I jammed on the brakes . . . too late.

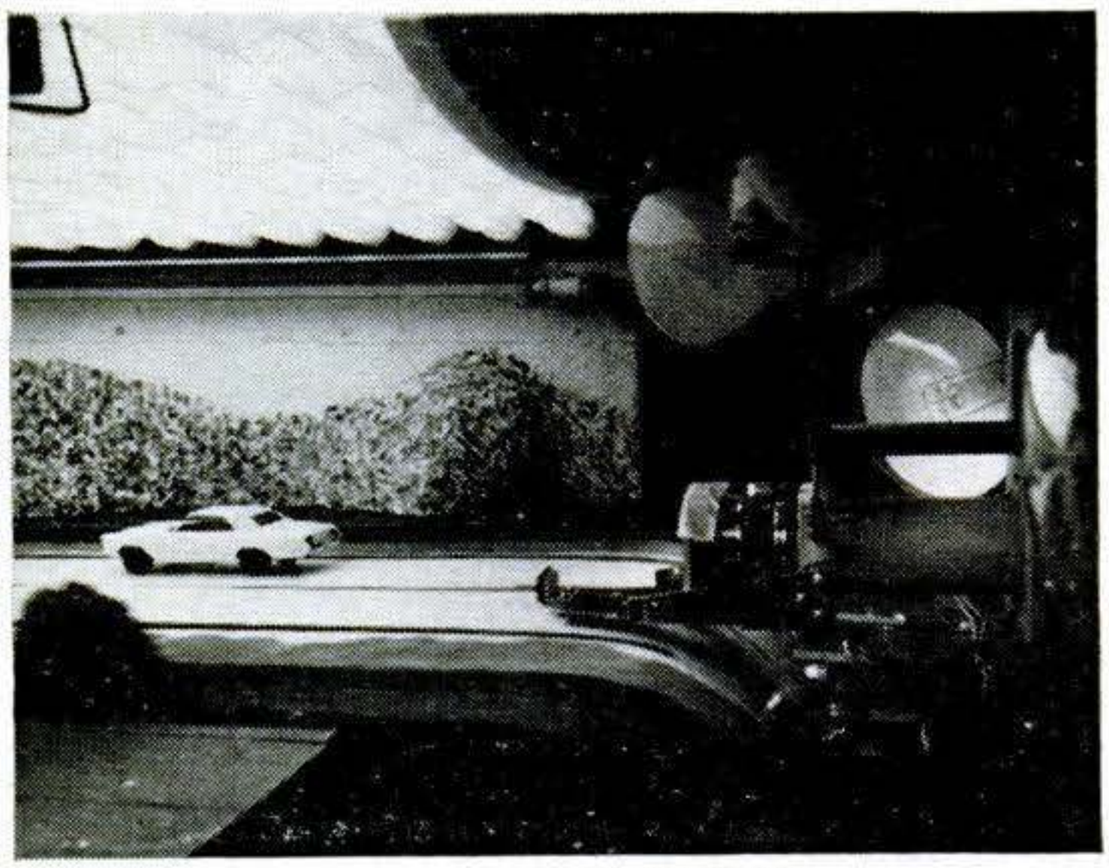
Terrified, I watched the rear of the car loom up in the windshield, and instinctively braced myself for a rending crash.

Driver of TV simulator sits in Plymouth wired with transducers and draped with TV monitor and windshield mirror. So real is illusion, drivers have panicked and jumped out of car when threatened by an accident. Simulator was designed and constructed by Goodyear Aerospace and Philco Corporation.

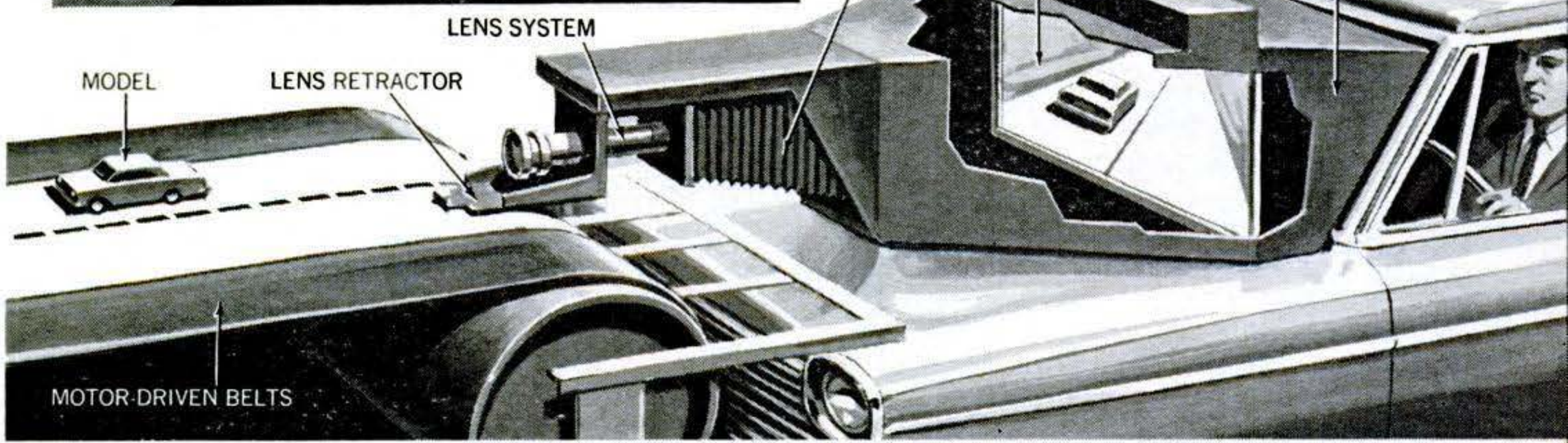
An instant later there was a gentle "pop" as a lens retracted out of the way.

Pazera, watching me brace myself in the seat, roared with laughter. "You make a good subject," he told me. "We

Motion, traffic, scenery, and motor noises all contribute to realism



In the belt simulator, five belts—two for scenery, one each for center line and two road lanes—carry model cars down "road" (left) under intense lighting. Lenses project their images onto a screen similar to frosted glass (below), which replaces the windshield in a Rambler. Cars can be programed in at any time and speed, and the scenery, held by Velcro fasteners, can be replaced by operator to avoid repetition. Simulator was conceived by RCA.



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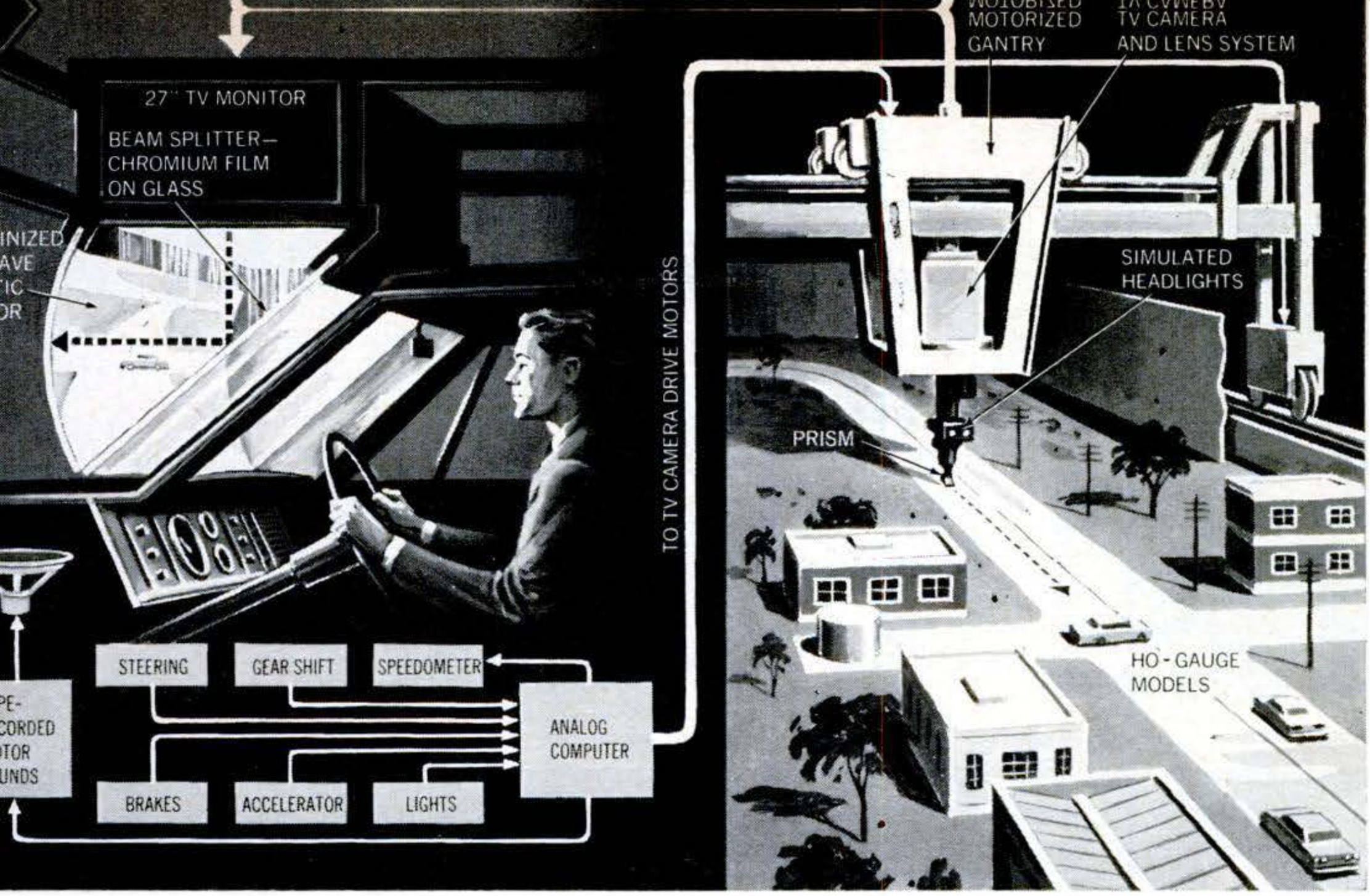

need people who take their driving seriously—who get involved and forget that we're not really traveling."

The town that isn't. Later I got to test-drive something quite different—the laboratory's TV simulator. This was built to give drivers a real town, with business, residential, industrial, and rural areas, neatly laid out on a huge HO-gauge (87:1 scale) landscape.

Closed-circuit TV and a mirror system make everything look life-size when you sit in the driver's seat of the Plymouth that is used in the machine.

Lost in the magic of traveling through a town that doesn't exist, I drove past stores, office buildings, a railroad station (a moving train was coming toward the crossing and I scurried across).

Making a left turn at an intersection, I found myself in a pleasant residential area. Then the houses thinned out. Glancing down at the speedometer, I saw I was doing 40, and I speeded up. Mountains, trees, a lake swung past. I maneuvered out to get around a car parked half on the road, half off, and said a few unkind words about careless drivers.

A few minutes more brought me to a crossroad. As I approached, a Toronado shot across the main highway. Again I jammed on the brakes—just in time—then leaned back limply.

"You're getting better," Pazera said.

Improving your driving. While the driving simulators can be regarded as fascinating toys, they are part of a deadly serious program being undertaken by the Center for Urban and Industrial Health, a part of the Public Health Service, which is, in turn, a part of the Department of Health, Education and Welfare.

Under the leadership of Dr. Richard E. Marland, chief of the injury-control program, and Robert K. McKelvey, director of the driving-research laboratory, scientists are trying to find out why you drive the way you do and what can be done to make you a better driver.

For the first time, too, it will be possible to make systematic studies of the effects of alcohol on driving.

"We'll test subjects before and after they consume a measured amount of alcohol," Bob McKelvey told me. "That way they'll serve as their own controls. If their driving gets even slightly poorer after a drink or two, we'll know it.

"We've got all kinds of questions we'd like to answer: Does stopping and drinking coffee really help control fatigue when you're on the road? What effects do benzedrine, tranquilizers, and other drugs have on drivers? There are probably prescription drugs being used that cause accidents, and no one knows it."

Needless to say, the Public Health Ser-

[Continued on page 178]

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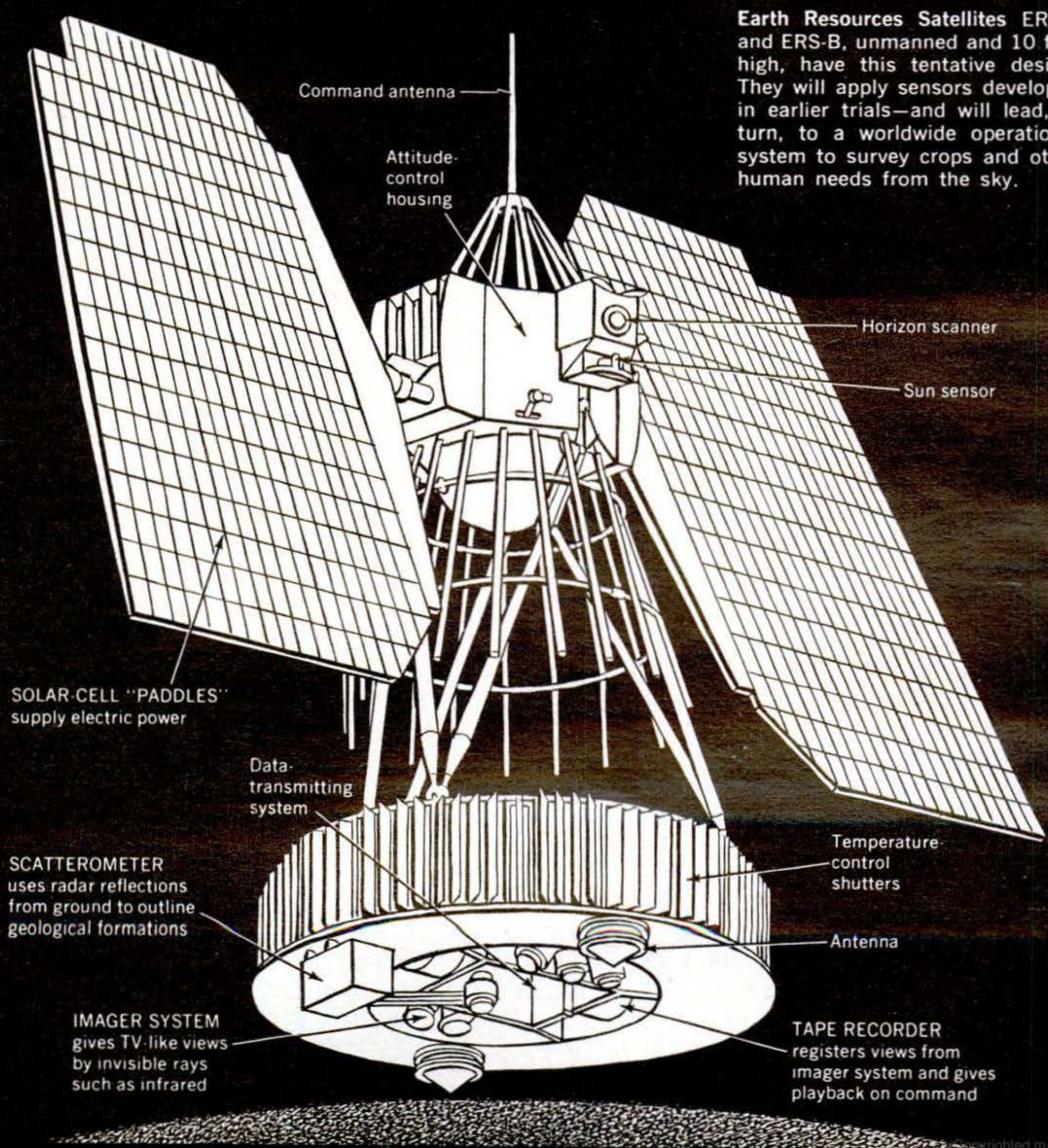
Eyes in the Sky Wil

By viewing our globe with cameras, radar, and TV-like sensors, coming Earth Resources Satellites will bring latest reports of growing crops, cattle, fish, timber, and minerals

By DR. WERNHER VON BRAUN
Director of NASA's George C. Marshall Space Flight Center, Huntsville, Ala.



Earth Resources Satellites ERS-A and ERS-B, unmanned and 10 feet high, have this tentative design. They will apply sensors developed in earlier trials—and will lead, in turn, to a worldwide operational system to survey crops and other human needs from the sky.

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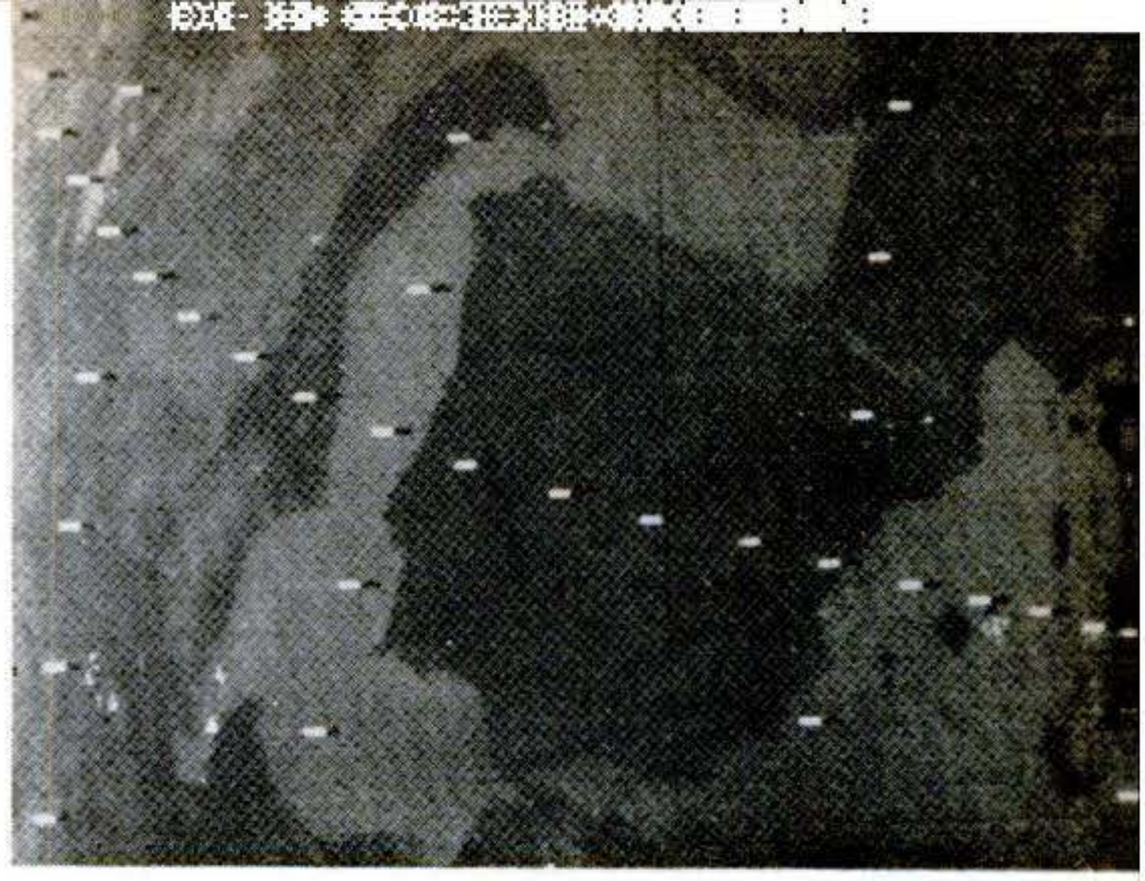

View of Spain from Nimbus II satellite gives a sample of what orbiting sensors can reveal. Banded pattern of sea west of Spain, in infrared picture, charts water temperatures—an aid in locating fish.

As we are setting out to explore the moon and the planets, we have discovered that the most interesting object to study from space is our own earth. Scheduled to begin in late 1969 or early 1970, three manned flights of the Apollo Applications Program will scan the globe with tools originally conceived to explore other worlds—sophisticated cameras, spacecraft TV outfits, "side-looking" radars, other remote sensors.

Soon after, NASA plans to launch two unmanned Earth Resources Satellites, as the next step toward an operational system for a constant, worldwide survey of earth resources from orbit.

The term "earth resources" embraces everything man needs to survive on this planet. It includes food crops, cotton, fresh water, timber, oil, mineral deposits, fish, wildlife, cattle and sheep. To gauge these resources, we must continuously observe the land on which crops and cattle grow, and the sea in which the fish live. Suddenly this is becoming urgent.

Population experts foresee that in the year 2000, just 33 years hence, our earth will have to feed twice as many people as today. Unless we make the most of the time left to find how best to use our limited earth resources, the vast majority of mankind may soon be locked in a struggle for sheer survival.

Satellites to the rescue. Earth Resources Satellites may well change the course of history. They may prevent wars born of starvation, by helping to provide food for the two-thirds of the world's population now inadequately fed. They could lift underdeveloped nations from poverty by locating unknown deposits of oil or minerals.

That's why NASA, encouraged by the Departments of Interior, Agriculture, and State, has embarked on a program to develop the technology for future Earth Resources Satellites.

The fabulous earth pictures taken by Gemini astronauts with a hand-held Hasselblad camera gave the idea its biggest boost. Our meteorological satellite Nimbus II demonstrated another kind of sensor—an infrared imaging system that showed not only continental outlines but also water masses of various temperatures. Such information, together with measurements of plankton content (indicated by a greenish hue of the water) and salinity (determined by a satellite-borne polarimeter), may one day locate schools of fish.

Now the Earth Resources Satellite program has progressed to some tangible hardware of its own.

Planes test new sensors. To gauge the usefulness of a variety of prospective instruments for Earth Resources Satellites, the Manned Spacecraft Center in Houston is currently flying them in two specially equipped aircraft, a Convair 240A and a Lockheed P3A.

With photographic, radar, infrared, ultraviolet, and microwave sensors, the aircraft get images of terrain that are especially suited to the geologist, hydrologist, geographer, oceanographer, agriculturist, or forester. Comparing them with the "ground truth," found by ground inspection of the areas flown over, has shown how to interpret the aerial images.

What do these "earth sensors" look like, and do? Here are some examples:

- A multi-spectral camera photographs the same terrain on two or more color films at once, using a different filter with each film. The respective films' tonal differences tell the quality of the soil, and identify the particular crop that is growing on it.

Continued

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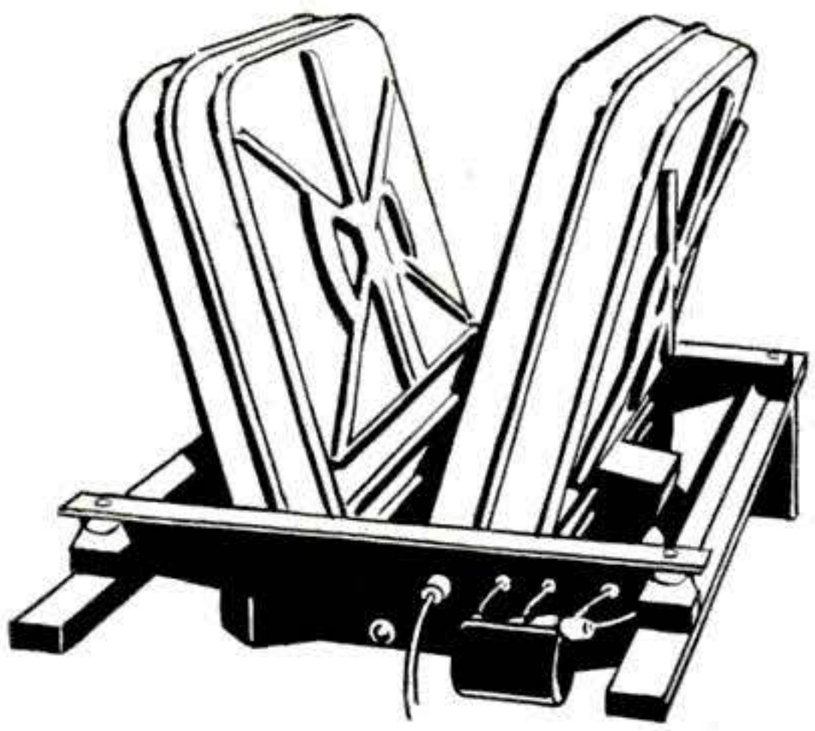
• An imager, especially useful in the infrared region of the spectrum, gives TV-like images. These go to a tape recorder, along with code signals to identify the areas viewed. On command from earth, tapes are "dumped" by radio to a ground data-collecting station.

• A scatterometer, a radar device, determines reflection characteristics of the ground. For instance, it can show the outlines of the rocky backbone of a mountain range overlaid by soft soil or sand. This is of great importance for geology and ore prospecting.

Already Houston's work has resulted in selecting a number of particularly promising sensors, besides producing a technique of data cataloguing and distribution that offers a kind of prototype for future satellite-borne systems.

Tests in orbit. Next, the sensors must prove their worth at orbital altitudes, in three of the manned Apollo Applications flights. A multispectral camera will ride the first flight; the others will carry a whole array of additional sensors.



Multi-spectral camera makes photos on two films through different filters. Tonal differences between films identify crops and tell soil quality. Instrument shown was developed by Mark Systems, Inc., Santa Clara, Calif.

Each of these flights will last between one and two months, much less than the useful life of future operational Earth Resources Satellites. But the Saturn-boosted Apollo spacecraft's large payload capability will permit a full complement of instruments. And trained scientists aboard will be able to detect from orbit any unforeseen clues to natural or artificial phenomena on earth, which might open exciting new possibilities.

The Earth Resources Satellites that follow, ERS-A and ERS-B, will use whatever sensors emerge from all the trials. Probably these small unmanned satellites will outwardly resemble Nimbus. While lacking the advantage of sophisticated adjustments by an astronaut aboard, they will be less expensive and longer-lived than the preceding manned flights. They may even have some operational usefulness—though they really are only laying the groundwork for an operational worldwide system.

That "ultimate" system might employ a combination of low polar and high synchronous satellites—whether manned or unmanned, it is still too early to say. It is bound to be subject to refinement, improvement, and expansion for many years.

Possibilities of such a system kindle the imagination. Airplane tests have shown that the new sensors will tell a wheat field from an oat field, a rice paddy from a corn patch, soy beans from cotton. Photos and sensor images clearly show if crops are thriving, or expectation is poor. Too much salinity in soil, inadequate soil-moisture control, lack or wrong use of fertilizer, hail damage, drought effects—all come to light at once, to the eye in the sky.

The same instruments reveal how the world's population is spreading. Growth of cities, and road construction, tell the story. Determining where the food is and where the eaters are provides the two factors of supply and demand that we must know if we want to see that nobody goes hungry.

Added uses. The list of uses of an Earth Satellite System is expanding. It could warn of volcanic eruptions, earthquakes, tidal waves. It could help discover underground streams to irrigate parched fields nearby. It could chart areas of pest-infested timber, to guide rangers in spraying from the air. It could provide a simple tool to update all the world's maps.

Finally, an integrated Earth Resources system is by no means limited to direct observations from orbit. Its satellites may also collect information by radio from unmanned probes on land and sea—and promptly relay those messages, too, to a central data-collecting station.

Today it looks as if man can no longer exploit natural resources arbitrarily. They are not inexhaustible. The time to act is now—and our Earth Resources program pioneers the way. PS

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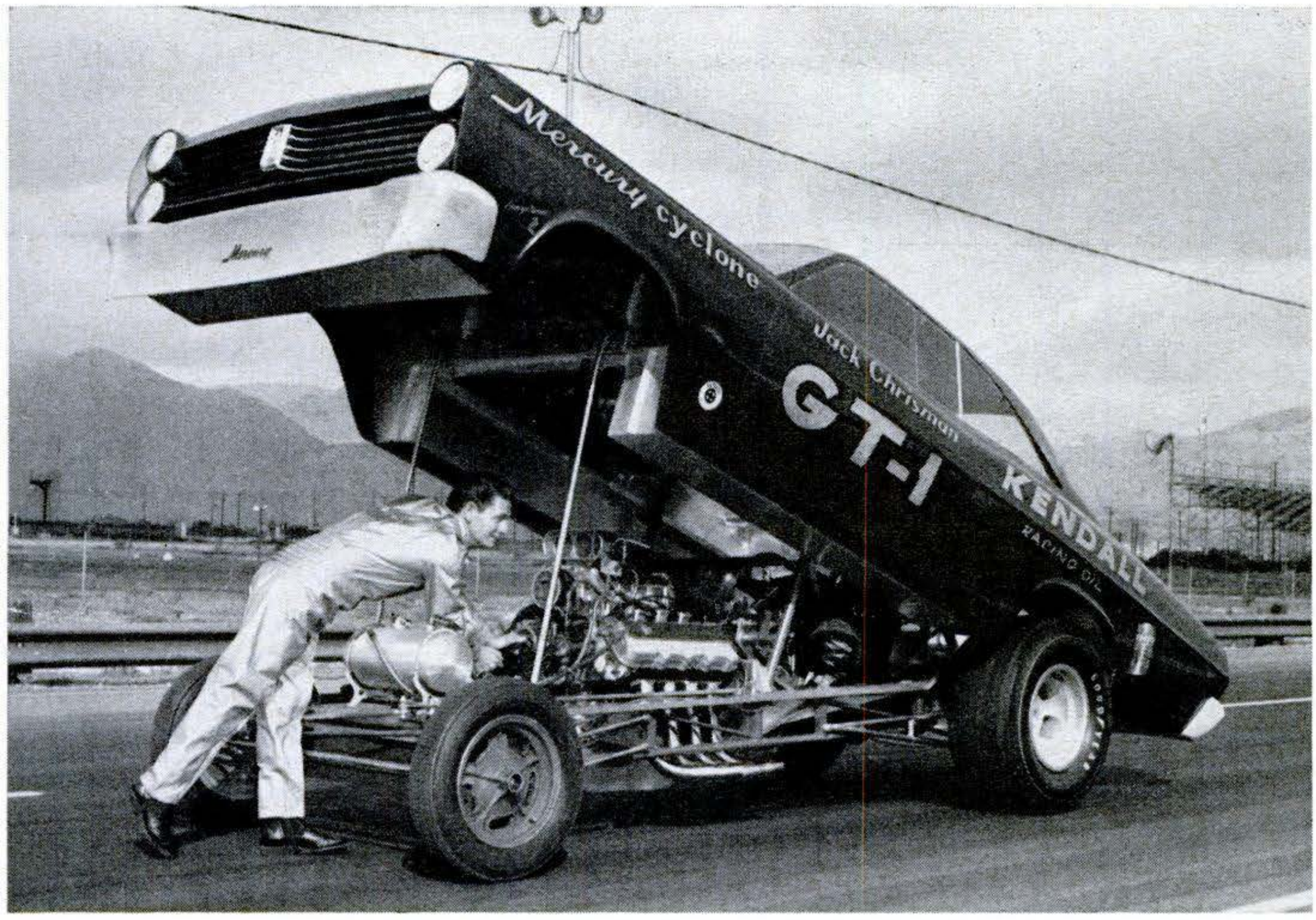

Dragster body is a flip-top

One of the "funny cars" on the drag strips this year is this Mercury Cyclone, with body hinged at the rear so it can be raised for work on the engine. Made of fiberglass, the body weighs only 205 pounds. The whole car weighs less than 1,800 (a standard Cyclone scales 3,600). The engine's midships position adds traction.

Boat can be carried in car trunk

This kayak comes in three pieces and is designed to be carried in the trunk of a car. Made in England, it's said to be the first collapsible hard-skin canoe. It's assembled in two minutes by fitting the interlocking hull sections together with toggle fasteners. No tools are required. It's 20 percent lighter than standard canoes.

Giant siphons transfer water to river

When a concrete sluiceway and lock through a levee near Marked Tree, Ark., washed away, the Army Corps of Engineers designed three huge siphons to carry water over the levee's crest from a cement catch basin to the St. Francis River. This maintains a sufficient river level for navigation. The siphoning is started by exhausting air from the pipes. Varying the number of pipes used controls flow.

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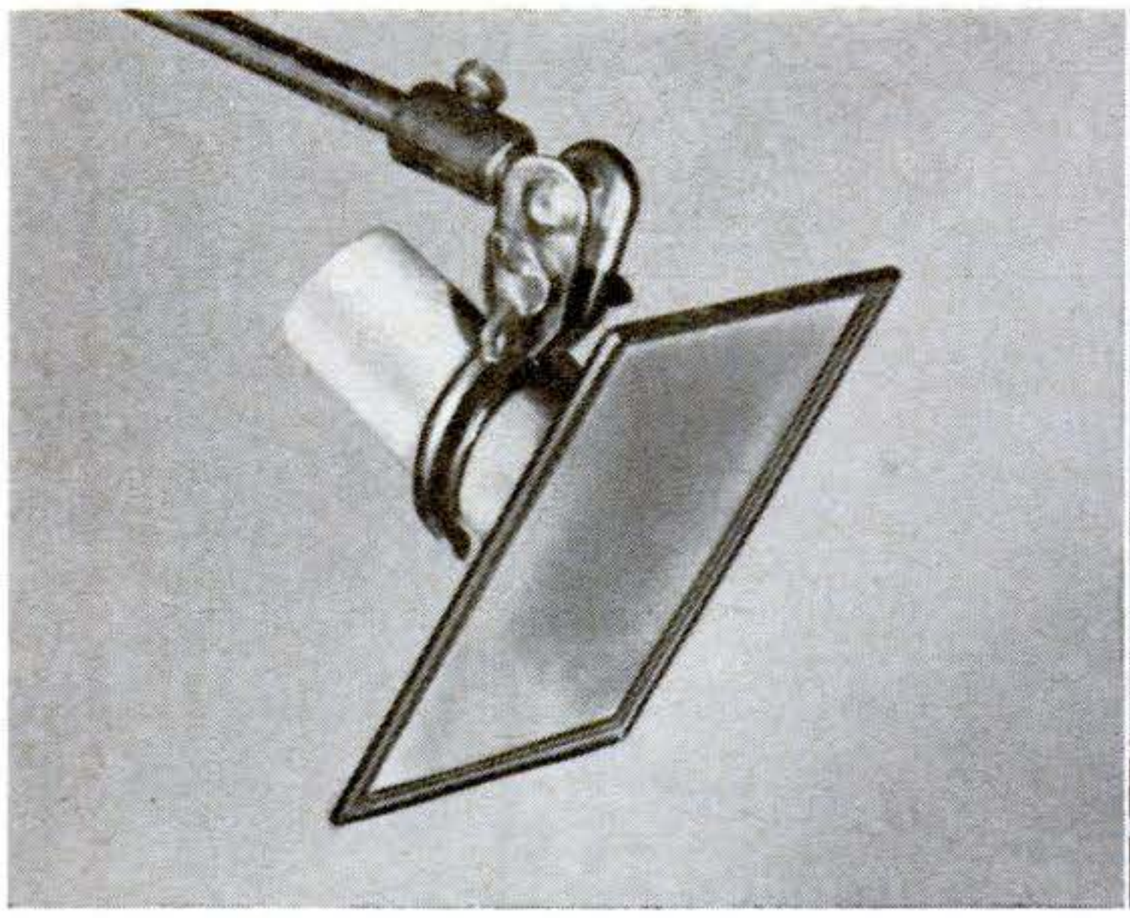
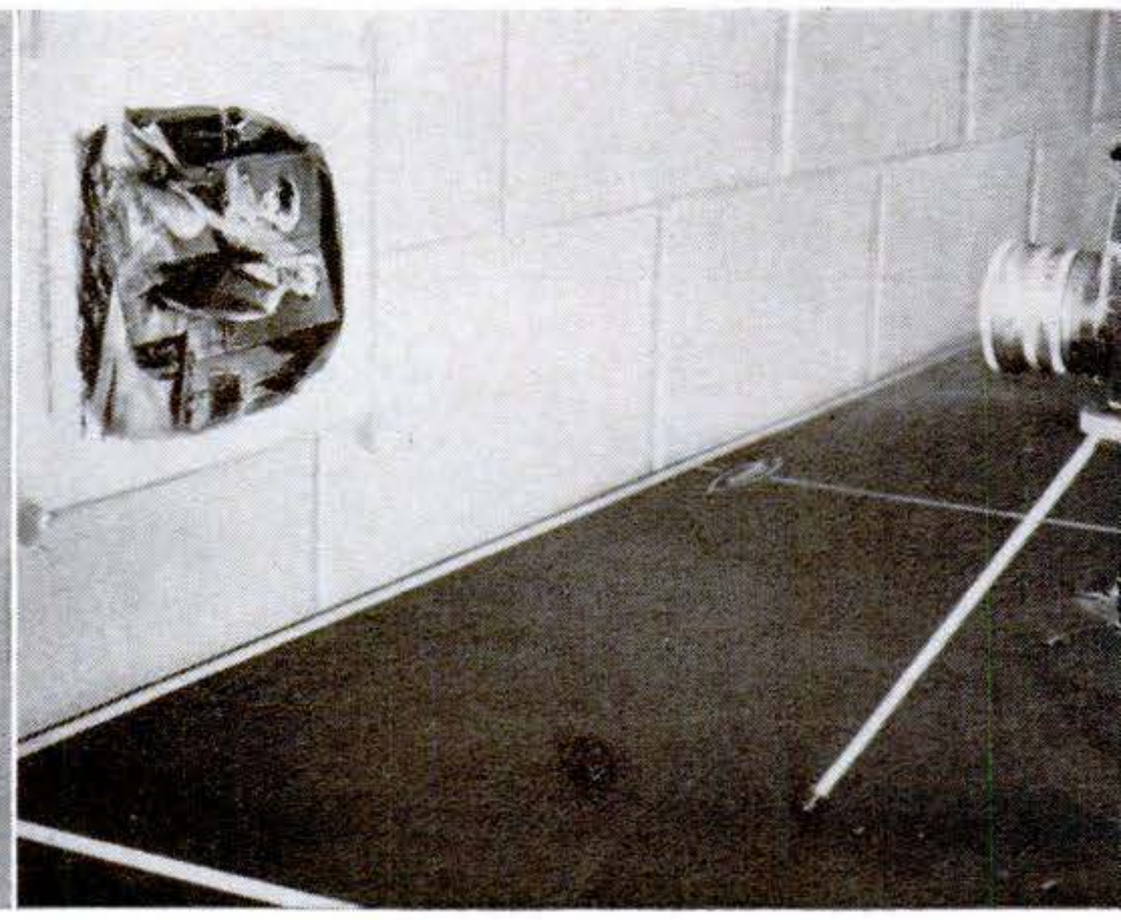




Little mirrors pick out highlights

Take a tip from the pros and make up small mirrors like this to help your flash or floods do double duty. They'll bounce interesting highlights into still lifes; or, behind and above a portrait subject, serve as "hair lights" for single-flash pictures. To make them, glue on stubs of 1⅛″ dowel. Swiveling flood clamps hold them in place.

DAVID JORDAN, Des Moines, Iowa.

Cartoons put fun in slide show

Whenever I come across an amusing full-color cartoon, I clip it out and save it against the time when I have a few unexposed frames of color film in my camera. I then copy these cartoons as shown, using a single flood slightly above and behind the camera (fitted with close-up lens). The cartoons will liven up almost any slide show.

R. J. PHILLIPS, Uncasville, Conn.

Easy-to-make viewer lets you see your negatives as positives

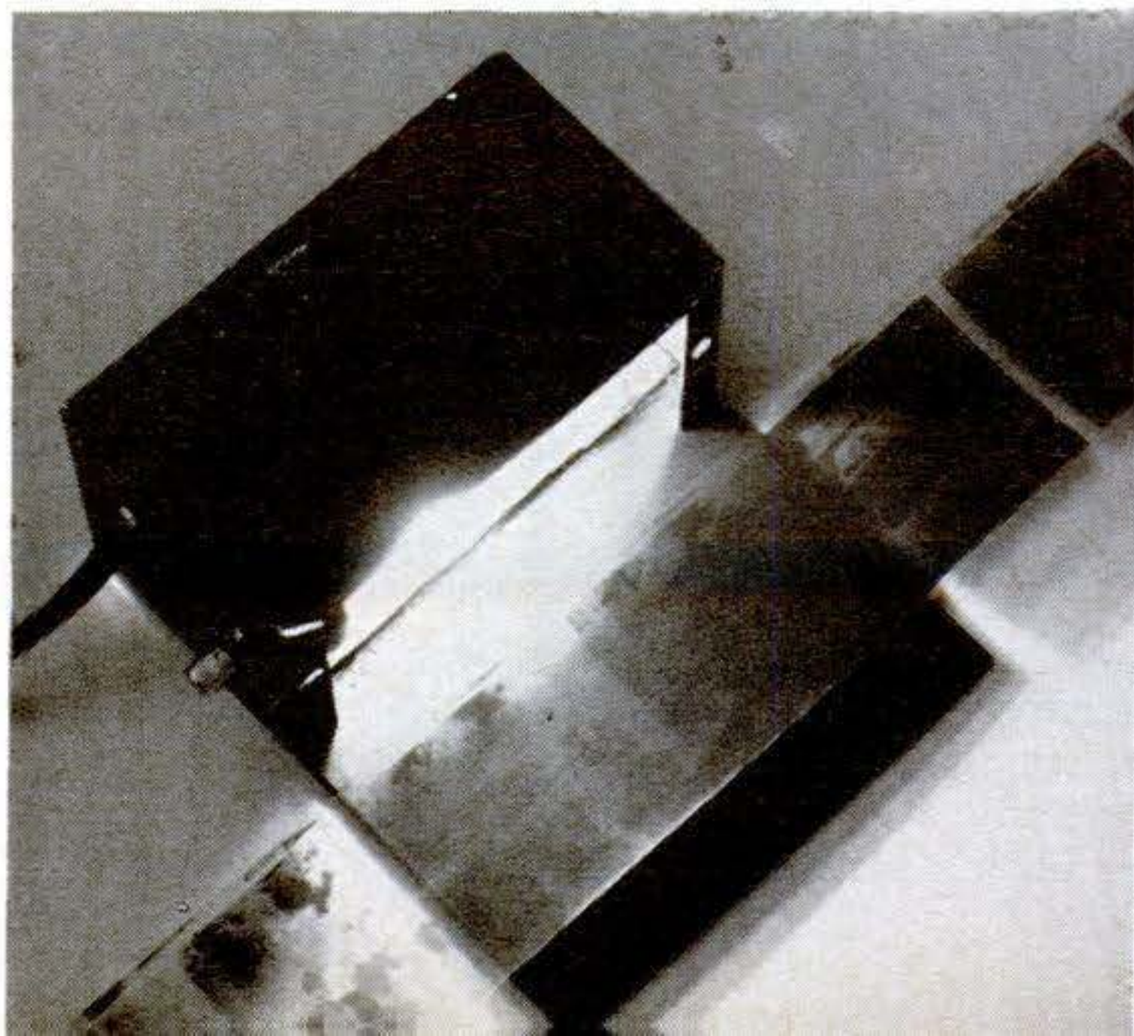
Most photographers have had the experience of tilting a negative so it caught the light just right and appeared momentarily as a positive. There's no mystery in this. When light reflects off the film emulsion to the eye, the silvered part of the negative appears light, and the clear part, if held against a dark background, appears dark.

My device uses that principle. It's a 2″-by-2″-by-4″ aluminum minibox, with a slim 15-watt bulb inside, cemented to a 4″-by-5″ base. It takes negatives up to 2¼″ by 3¼″.

I removed one side of the box, drilled two holes in one end (for the switch and for the lamp cord), and then cemented the box to the base with silicone-rubber adhesive. The same adhesive holds the socket in place. Everything except the inside of the box is painted flat black.

The positive image is a little vague, but it's fine for identifying a neg on a strip.

BYRON G. WELS, NYC.



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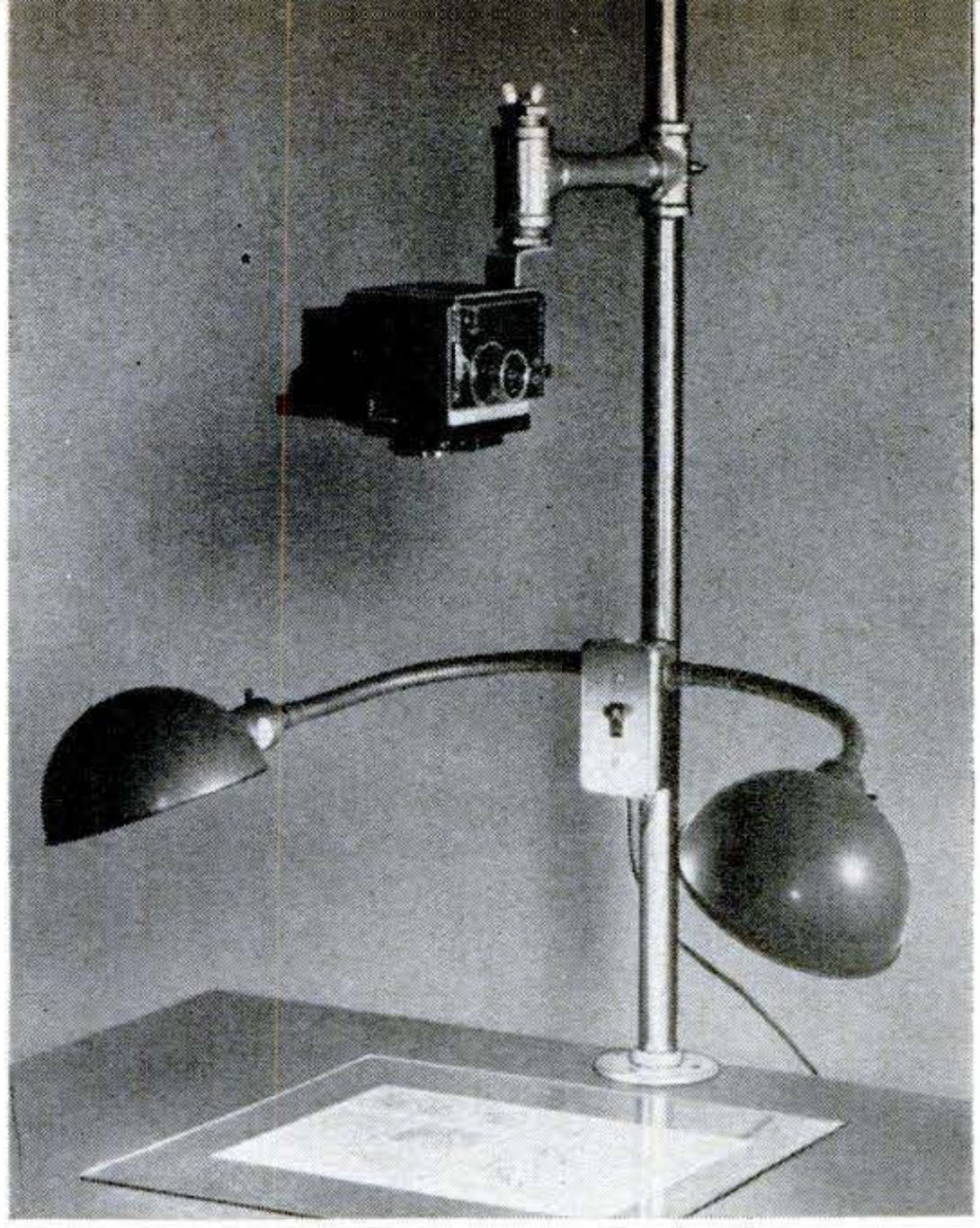
PS READERS

A tackle box—ideal camera case

As a specialist in outdoor photography, I got disgusted with leather and vinyl bags: They leak dust and water—no good in a dusty field or on rough water. A fisherman's tackle box solves most problems: The better ones are water- and dust-proof; the trays are fine for accessories and film; and cameras fit neatly in the bottom.

C. Boyd Pfeiffer, Baltimore.



Copy stand is a pipe dream

Standard pipe and fittings make this rugged copy stand. The upright is ¾″ pipe. Two ¾″-by-⅛″ hex reducers are screwed into one tee, with a ¼″ stove bolt (run through) and a wingnut to hold the L bracket. Ream the tee on the upright so it slides freely. A thumbscrew locks it. The switch controls both lamps.

W. G. Waggoner, Sacramento, Calif.

Hammer holder carries a tripod

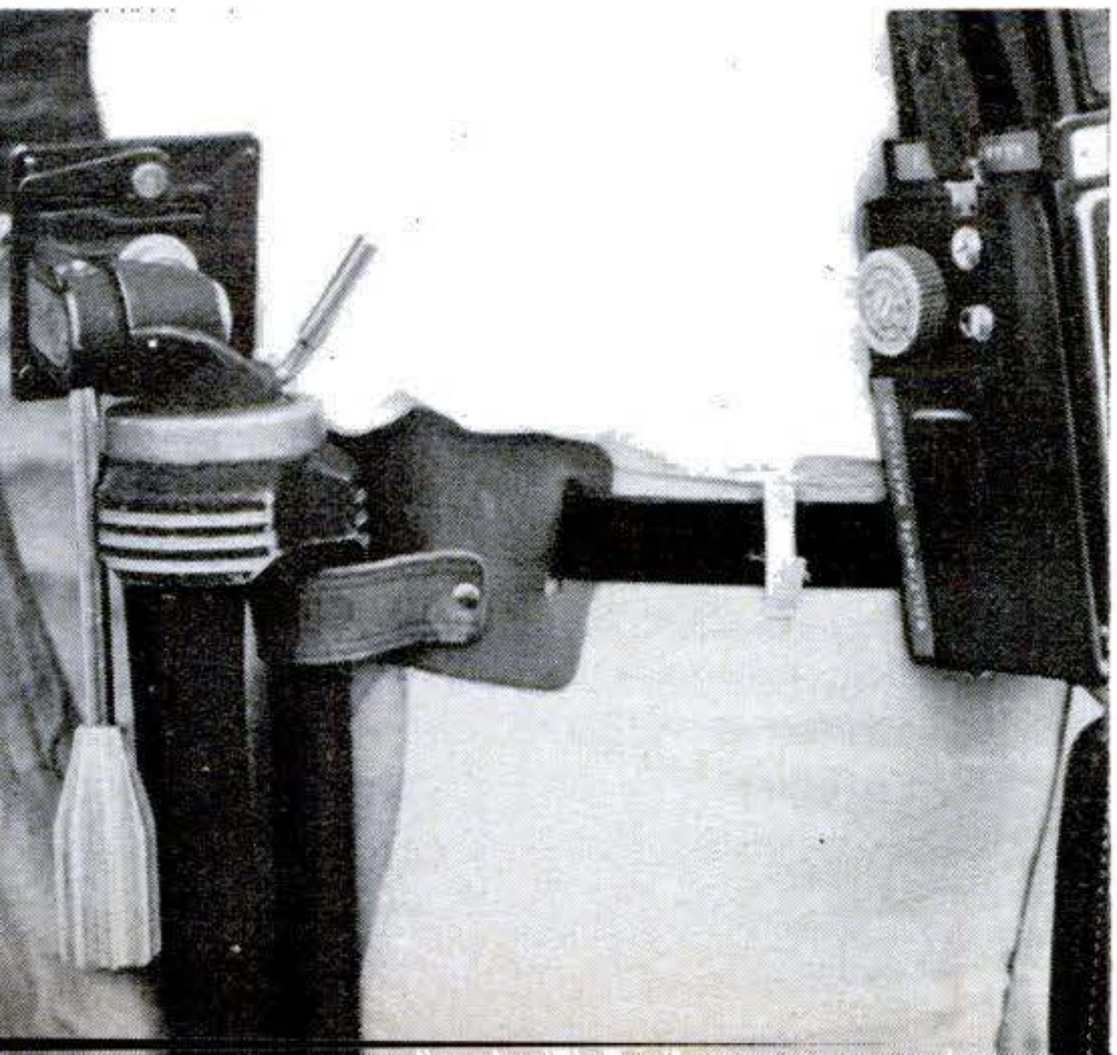
Here's a handy device that enables you to carry a clumsy tripod around, yet have it ready for instant use when you need it. It's a carpenter's leather hammer holder. You slip one leg of the tripod through the loop and wear the holder on the side or back, wherever it's most comfortable. The tripod will be carried safely and comfortably; your hands are free; and you'll scarcely notice the extra weight.

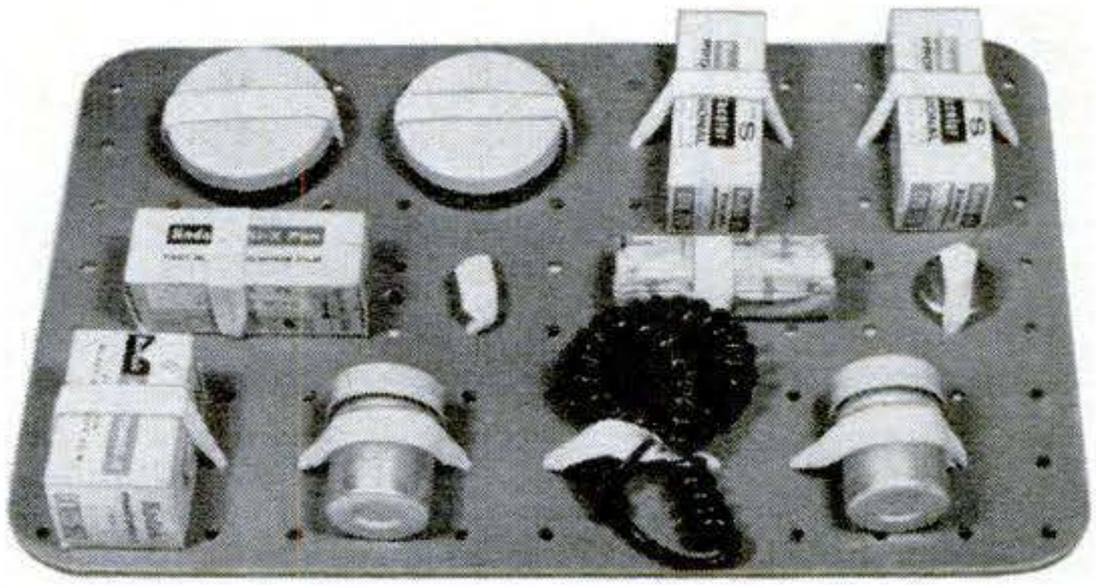
C. Boyd Pfeiffer, Baltimore.

Match-the-dots system for strobe

I worked out a handy dodge when the exposure calculator on my new strobe proved hard to read in dim light. Using my favorite film, I determined the perfect lens opening for each of five distances. Then I painted five different-colored dots on my camera's focusing scale. On the aperture scale I painted five corresponding dots based on my "statistics." Now, when I use my strobe, I just focus, match the dots, and shoot.

W. Page Thompson, Michigan City, Ind.





How to unclutter a camera bag

To unclutter your camera bag, secure small items to pegboard with interwoven elastic ribbon. Attach the board to the bag.

Arthur L. Ramos, San Anselmo, Calif.

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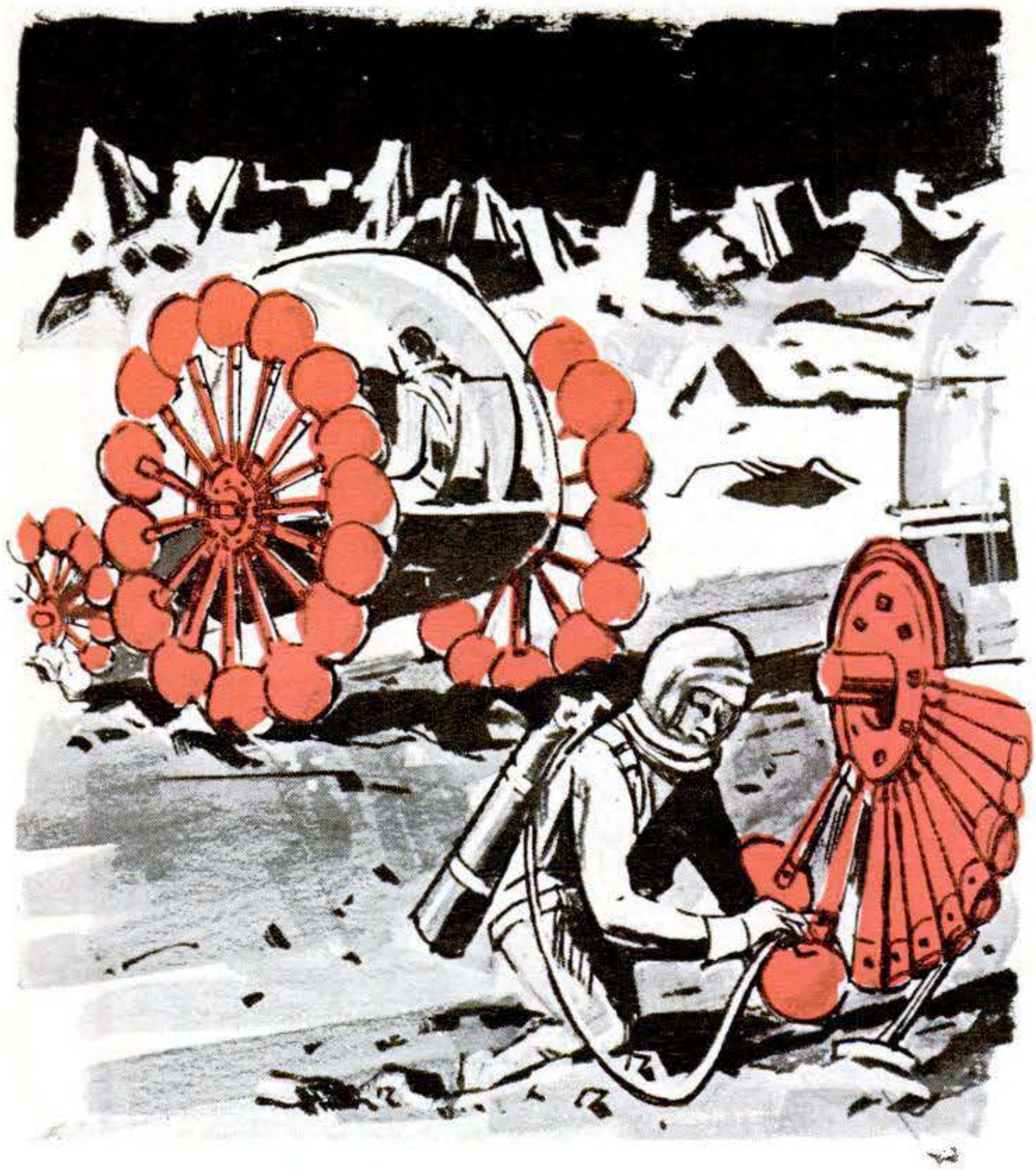
New Ideas from the Inventors

DRAWINGS BY WILLIAM CASTIMORE



Balloons for moon travel. For the large, soft wheels that may be needed for moon vehicles, a recent patent suggests tough inflated balloons at the ends of spokes riding in tracks in the hubs. Inflating the "feet" would fan out the spokes and form a wheel large enough to traverse rough, jagged terrain. Folding together the spokes would make the vehicle more compact for transport.

Seat belt fastens child's seat. A car seat like this one could be strapped—child and all—under the regular seat belt of your car. The belt would hold the young rider around the hips, instead of across the abdomen, so he'd be less likely to be injured by sudden stops. The resilient-foam seat would cushion normal driving shocks and raise the child for better vision all around him.

Soda can pops straw out. Packed diagonally inside a beverage can, this straw would pop up, when the can was opened, to provide a sanitary and convenient means of sipping the contents. A tab with a V slot would be formed under the pull-strip opener, and the straw would be gripped in the narrow end of the slot. After the can was opened, the straw would float up to sipping height.

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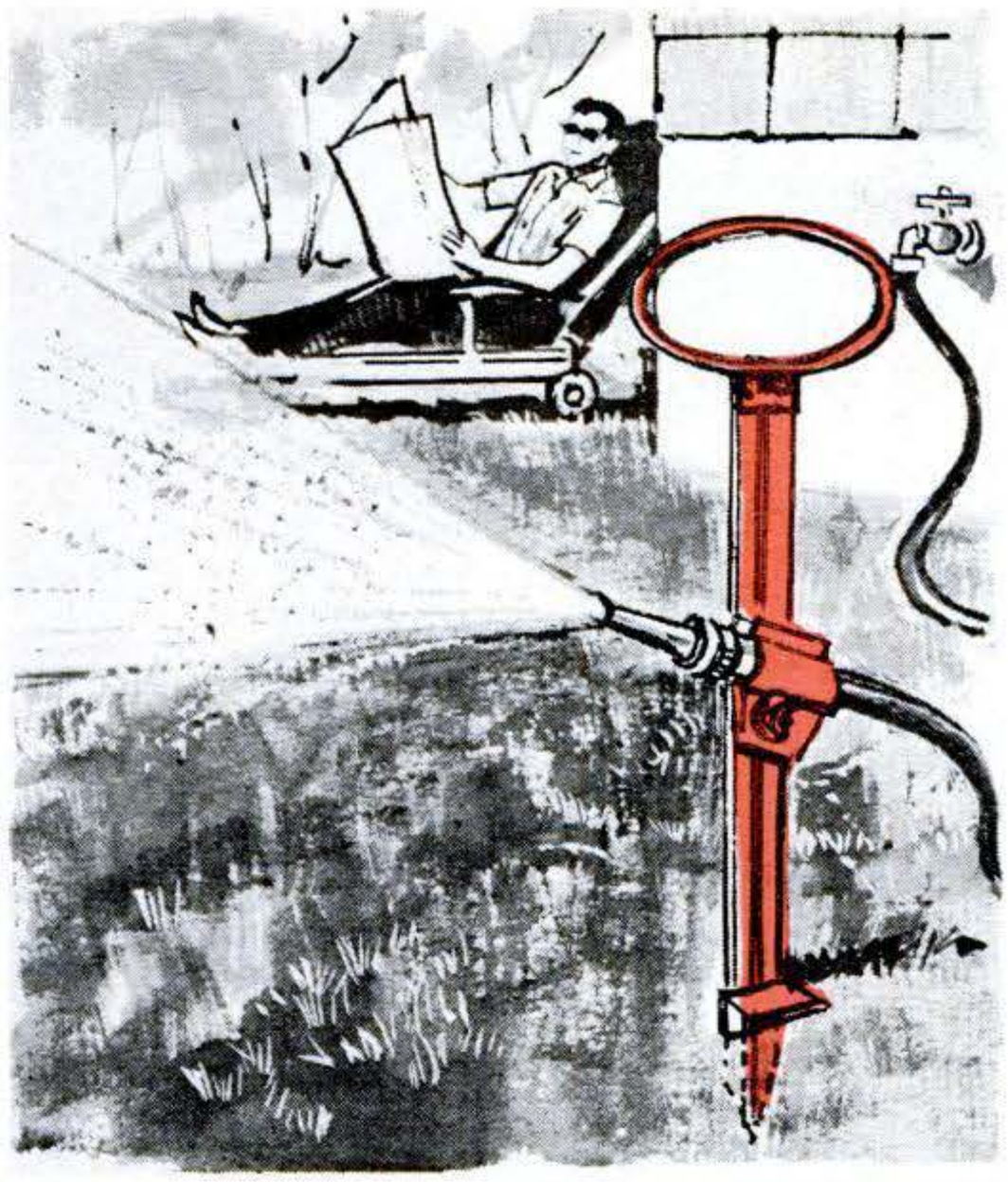
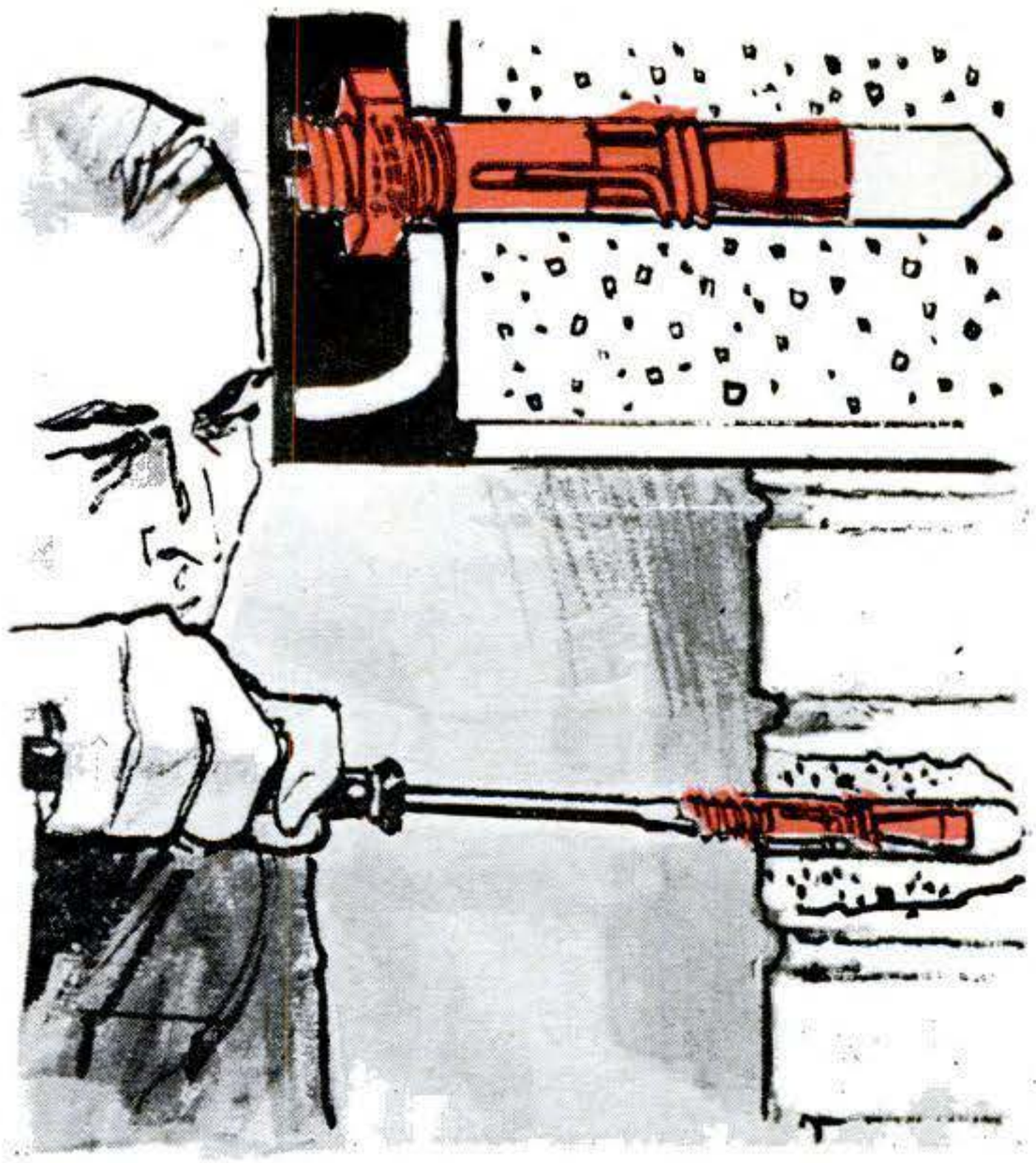
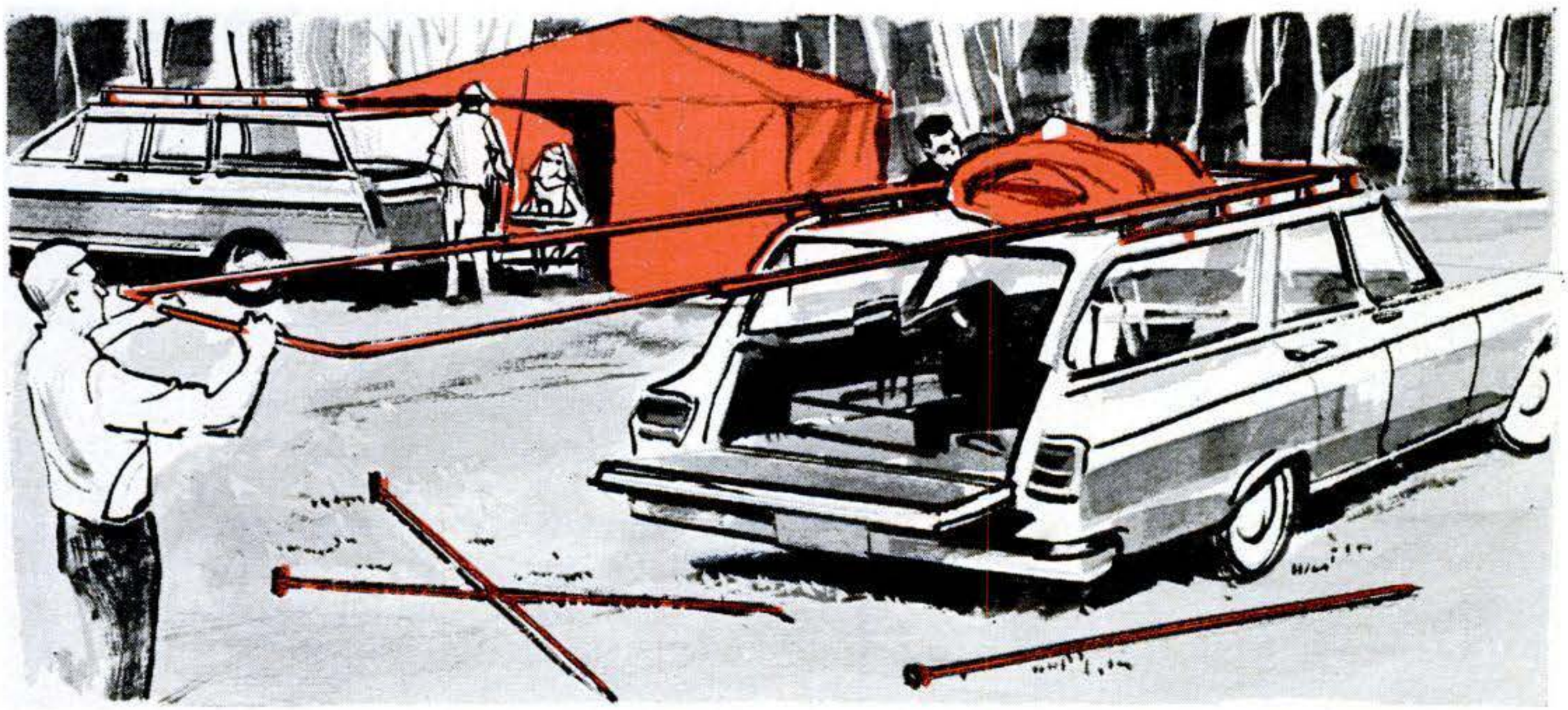


Post aims garden hose. You could take more time off from your watering chores if you had a post like this to hold and point the hose for you. You'd simply push the post into the ground and aim the hose, by means of an adjustable nozzle clamp, for the best height and spray angle. When you finished watering that spot, you'd move the device.



Expanding coil anchors bolt. Turning this bolt in a hole would unwind a coiled wire, increasing the coil diameter to lock it. Tightening a nut (which could hold a bracket) on the projecting bolt—or putting pull on the bolt—would slowly pull the bolt and its wedge out, expanding the coil further and locking the bolt more securely.



Car rack supports tent. A telescoping luggage rack forms the frame of this sturdy, easy-to-set-up camping shelter. Two crossed rods, fitted with U-shaped brackets would support the extended end of the roof rails; a longer center pole would hold up the peak of the preformed canvas tent. The car could form one wall of the tent.

The following patents have been issued on these inventions: **Moon-vehicle wheels**—*No. 3,291,181 to Glenn G. Havens, San Diego, Calif.;* **Child's car seat**—*No. 3,220,769 to E. V. B. Regan, Buffalo, N.Y.;* **Pop-up straw**—*No. 3,226,001 to Nabor Sequeira, Bombay, India;* **Hose post**—*No. 3,241,798 to Walter J. Nestor, El Portal, Fla.;* **Expansion bolt**—*No. 3,302,509 to Henry J. Modrey, Stamford, Conn.;* **Luggage-rack tent**—*No. 3,231,161 to Maurice Calthorpe, Los Altos Hills, Calif.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 50 cents each. To write to an inventor, if the address above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

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YOUR NEXT CAR MAY HAVE Variable-Ratio

An ingenious principle coupled with new driver research can give you a steering system with ideal characteristics—under all conditions—for everybody

By **JIM DUNNE** / *PS Detroit Editor*

Maybe you're the type of driver who thinks the steering on his car is too slow, that it takes too much steering-wheel movement to make an ordinary turn. Or perhaps you're the other kind, one who thinks that steering response is too sudden, that his car changes direction too sharply when he turns the wheel.

A fixed-ratio steering system is a compromise between drivers' likes, needs, and uses. An 18:1 ratio may not be ideal except for a 10-m.p.h. portion within a 70-m.p.h. speed range. But the driver is stuck with the same ratio at all speeds. He gets an undesirable control characteristic through most of his driving range.

But I have good news for you. A highly advanced steering system that gives most drivers ideal steering response—lowers the numerical ratio as you increase the steering-wheel movement—may soon become the "normal" way to steer a car.

That's one of the conclusions coming out of a driver-steering experiment just completed by the Cornell Aeronautical Laboratory in Buffalo, N.Y.

Cornell took a group of student drivers —young people who had little experience steering a car—and tested their reactions to different steering-gear ratios. After performing five different driving tasks, they were checked for three answers:

- Which ratio do you like?
- Which ratio felt "normal"?
- Which ratio do you dislike?

By a significant margin, the drivers pre-

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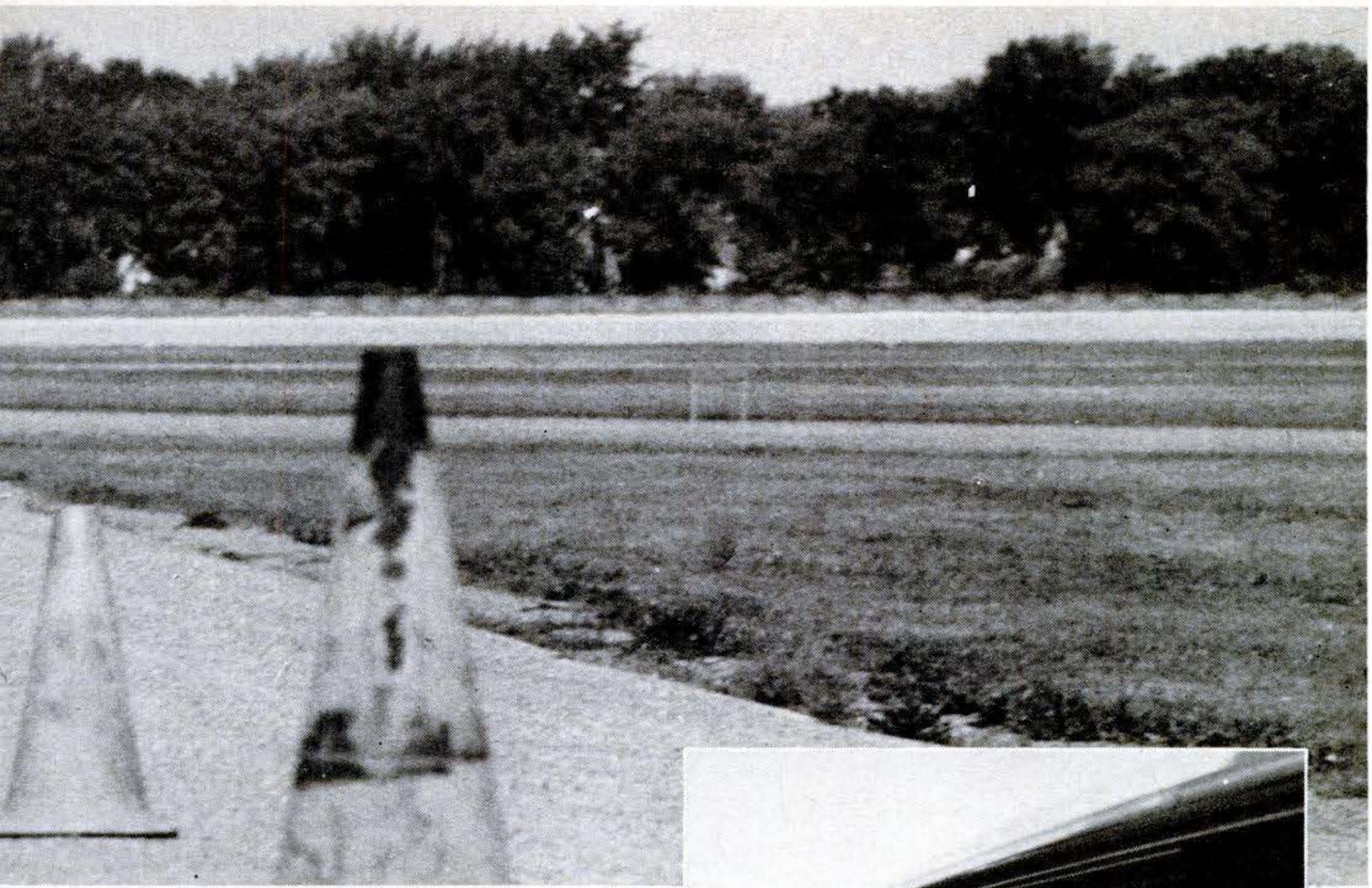

Steering

erred variable-ratio steering to the long-tandard, fixed-ratio steering used on al-nost every mass-produced car.

What's more, VRS (variable-ratio steer-ng) felt "normal" to these new drivers vho had no set idea of what "normal" teering systems are.

Five steering gears were used in the ex-eriment, two variable- and three fixed-atio, and all five were power-assisted see chart farther along).

By far the best-liked of the five ratios vas the 16.5:1-to-7:1 variable system. In econd place came the conventional 25:1 nd 15:1 ratios, just ahead of the second ariable-ratio system.

A closer look. Let's inspect that most-referred variable ratio. There's a big ifference between this one and the other ariable ratio tested, even though the on-enter and end ratios are nearly the same. 'he difference lies in the abruptness in hange of ratio—actually, the transition rom one ratio to the other as the steering

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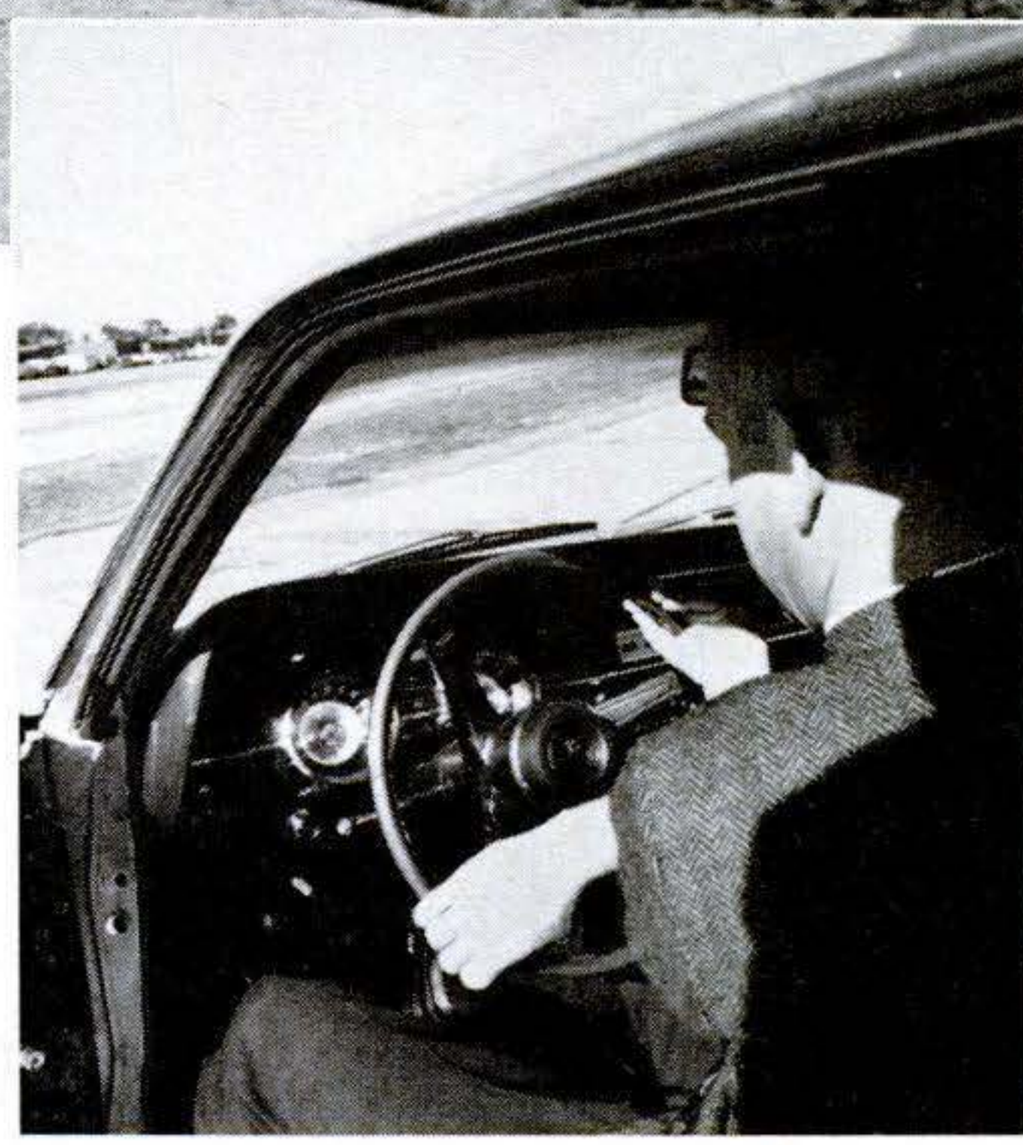

A half-turn of the wheel on this Cougar with VRS gives you almost full-left steering angle. A report from Cornell says VRS reduces effort, improves control, and can be an aid to safety.

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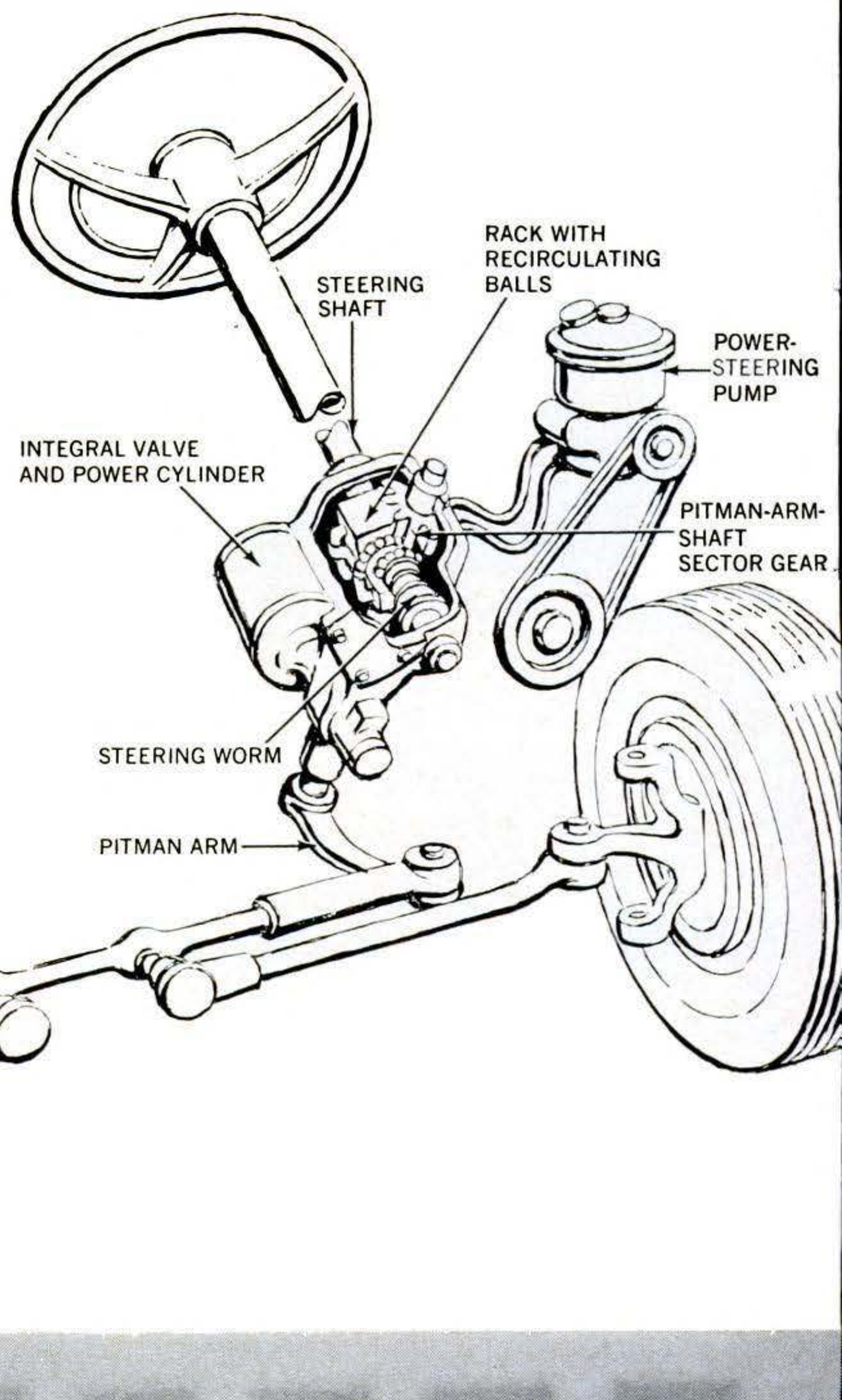
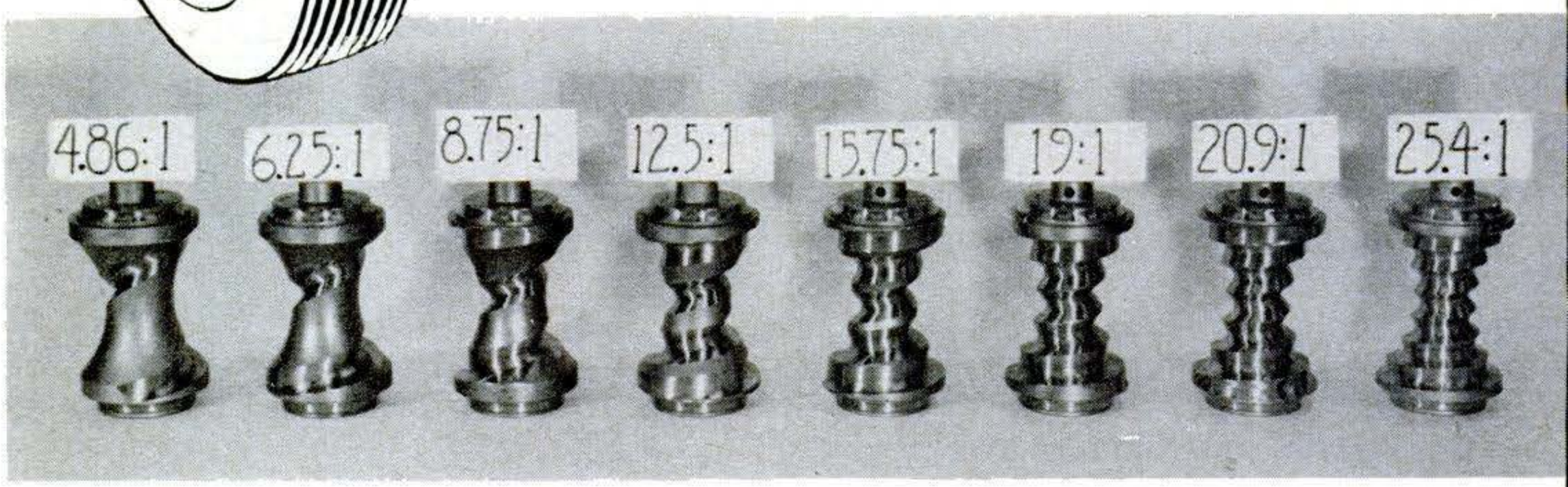
Integral VRS power-steering system

Turning motion in the steering wheel and steering shaft is changed to lateral motion in the linkage attached to the pitman arm. The ratio between steering-shaft revolutions and pitman-arm turns is called the steering-gear ratio. Overall steering ratios are usually about 10-percent higher because of the effect of steering-arm length. The block with the recirculating balls moves along the worm and turns the pitman-arm shaft. What determines the ratio is the shape of the worm gear on the steering shaft and its number of corkscrew-type windings. Photo below shows a selection of worms. They are easily interchangeable. Power assist is necessary with variable-ratio steering, because wheel angles increase sharply toward extremities. In an integral system, the control valve and power cylinder are combined with the steering-gear casing. The pump is mounted separately and driven by belt from the automobile engine or an accessory.





wheel is turned. On the best-liked system, the change from 16.5:1 to 7:1 is gradual. As traced on the chart, the change is shown as a more gently sloping curve.

Cornell's student drivers were tested to see how far they wandered from a curving path with each test vehicle. A curved line was laid out on a track and the students were told to follow the line as closely as possible. Deviation from the line was measured by an electronic sensor. The students drove in a circle, increasing speed each time around.

Results of this experiment showed that students using VRS guided their cars more precisely. In other words, novice drivers control their cars better with VRS than with fixed-ratio steering.

What puts VRS out front? Two outstanding advantages of VRS accounted for the students' vote of confidence:

1. Lock-to-lock turns are fewer.

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2. Speed of turning is matched to the speed of the car.

The number of times a steering wheel must turn 360 degrees before the tires turn from full left to full right gives you the lock-to-lock turns. On an average manually steered American car, lock-to-lock turns are about 5.5. With power steering, this drops to 4.25.

With VRS, the average lock-to-lock drops to less than three, and in many cases is close to 2.5. Thus cars with VRS can be steered with less work. They react quicker, and are easier to park.

While it is true that you can get the same quick reaction with a low fixed ratio, it has drawbacks that make it fatiguing to the driver.

Before we go on to the second advantage of VRS, consider these facts: A car moving at high speed—say 70 m.p.h.—can turn its wheels only so far before it begins to skid. A car at moderate speed—say 40—can turn much quicker without losing bite. At low speed—turning a corner in city traffic or in parking—wheels can be swung quickly from straight ahead to full right with almost no slip.

Now look at how perfectly VRS can be matched to the speed of the car:

At turnpike speeds, VRS systems let you zero in on the ideal setting without going past it. And a sudden swing of the steering wheel does not turn the wheels so far that they lose their bite.

At lower speeds, the lower ratios come into effect just when they are needed. Then you can take a corner with little wheel movement, low turning effort, and without fear of starting a skid.

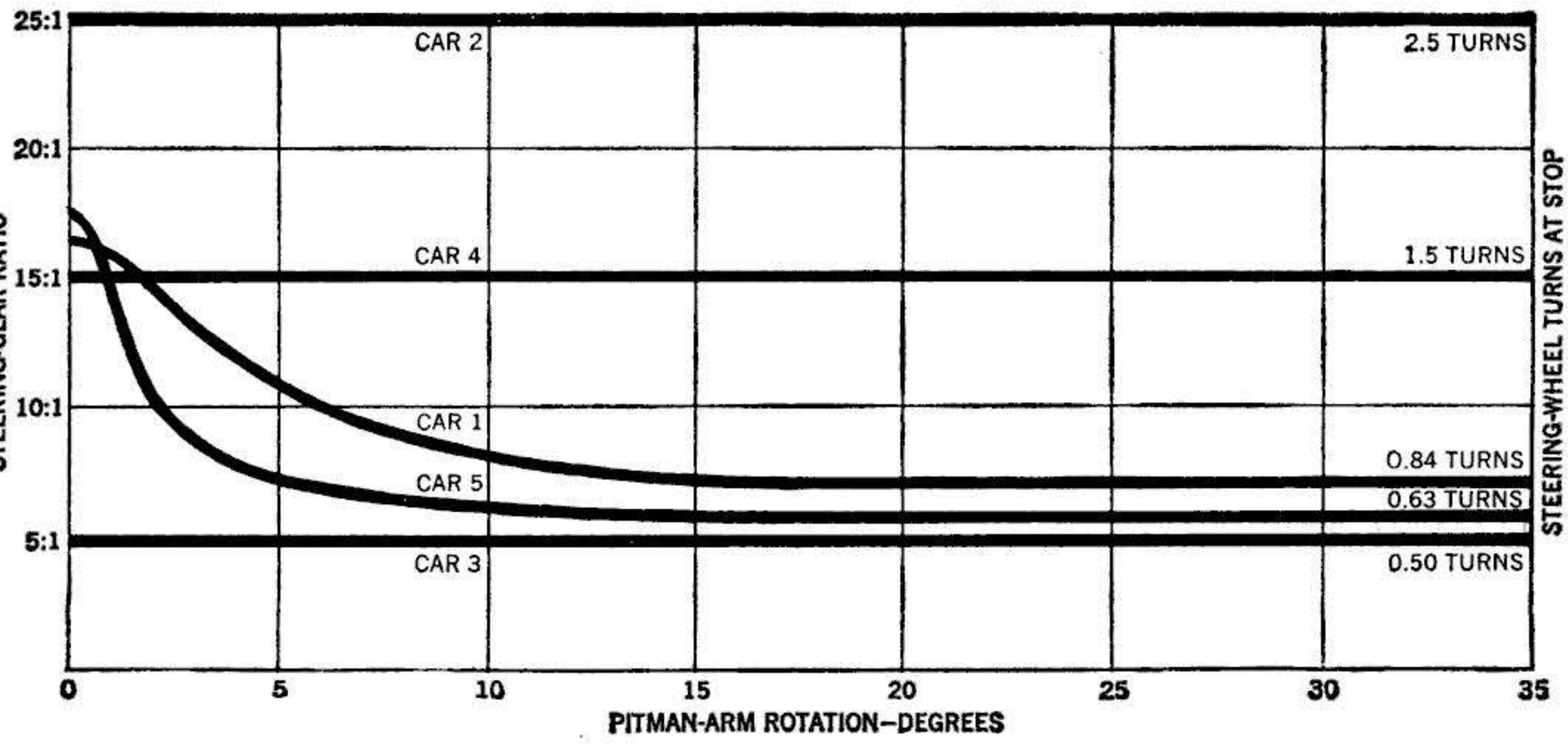
Why so few VRS cars? Only the Cadillac and Jaguar have VRS. Why don't more car makers use it?

Simply stated, the answer is that Detroit has ignored this advance because of pressures for other motoring developments, especially safety. The amazing thing about VRS is that it has definite safety benefits and costs virtually the same as straight ratio.

How do the auto companies feel about VRS in the future? Chevrolet, Pontiac, and Oldsmobile look favorably on variable ratios; Buick is dead against it now.

Chrysler, the company that pioneered fast-ratio power steering on American cars, says cryptically, "We are studying and developing VRS." American Motors has had VRS on test, too, but found an "abruptness of change" in the ratios they used. Ford will definitely change to VRS when it gets a supply built up. Meantime, '67 Ford pickup trucks with power steering have variable-ratio steering. PS

Steering ratios on the five test cars used by Cornell are shown below. Cars 2, 3, and 4 have fixed ratios 1-3 quickest in response, 2 slowest. Cars 1 and 5 had VRS. Car 1 was best liked, and Car 4 was preferred over Car 5, which had abrupt ratio transition. Gradual speed-up in response of Car 1 seems ideal for driving—the ratio changes from 16.4:1 to 8:1 in a 10-degree pitman-arm turn.



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Five Kits You

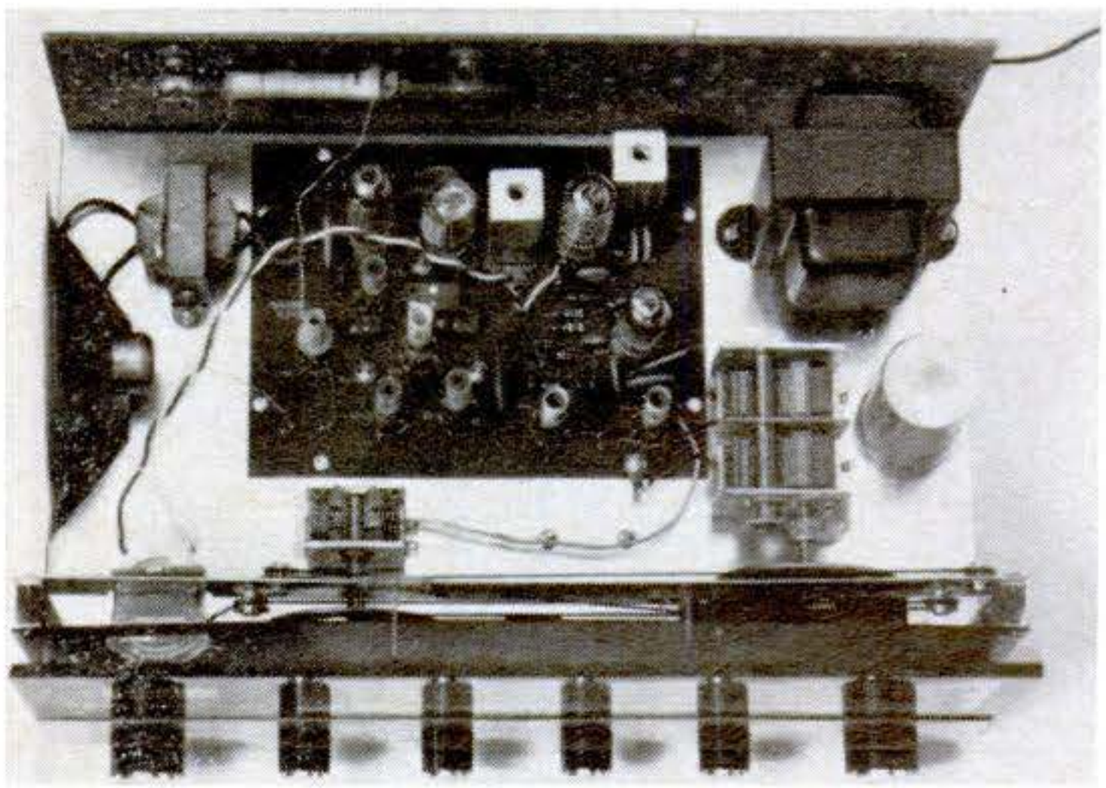
Take your pick—any or all of the five kit-built electronic devices pictured on these four pages makes a perfect off-hours project. This summer, why not turn your free time, some rainy weekend, into a stereo hi-fi, or a TV set, or a shortwave radio you'll enjoy all year?

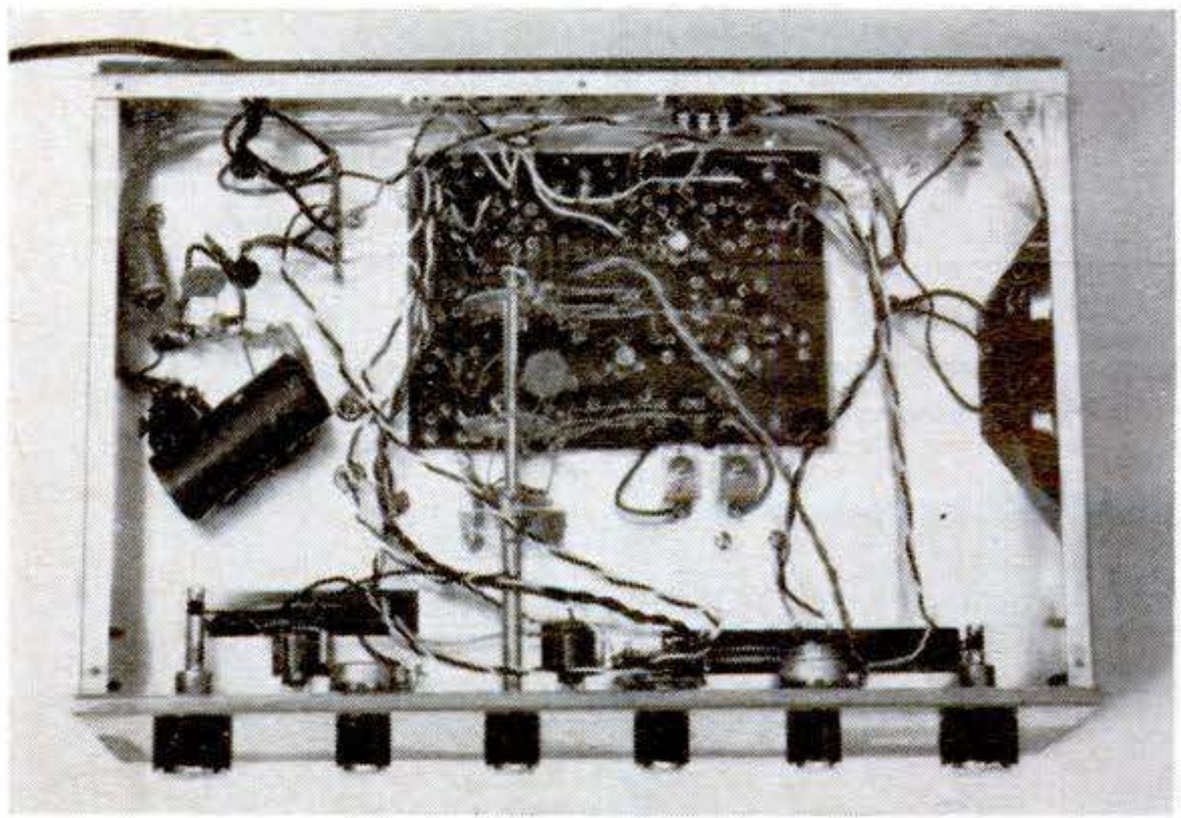
The five kits we selected all have two things in common:

- They are straightforward to build, although the group represents a considerable cross section of circuit complexity.
- Building any of them will save you money, since each costs considerably less than an equivalent factory-wired unit.

For further information, write directly to the kit manufacturers:

EICO, Inc., Flushing, N. Y. 11352; Knight (Allied Radio, Box 4398, Chicago 60680); Heath Co., Benton Harbor, Mich.





EICO SWL Radio

If you're tired of listening to the radio station down the block, try tuning in the English-language broadcasts from foreign capitals on this four-band (550 kiloHerz to 30-megaHertz) shortwave receiver. The EICO Model 711 Space Ranger kit costs $50, and it is one of the easiest-to-wire radio kits—of any type—that you can buy. Construction time is under 15 hours.

The reason: Almost every component, except the power-supply parts, is mounted on a single printed-circuit board (see photos, left). This eliminates the traditional all-wave-receiver rat's nest of tuning coils and capacitors, and creates a wide-open, easy-to-work-under chassis. The instructions are clear.

The circuit (four vacuum tubes plus two silicon power rectifiers) is simple, but its sensitivity is more than adequate for monitoring most of the popular overseas broadcast stations, especially if there's a good outdoor antenna.

One minor annoyance: Test equipment—a vacuum-tube voltmeter and a signal generator is required to adjust the various adjustable coils and capacitors for optimum circuit performance after the kit is assembled. Unless you have access to this gear, it means a trip to the nearest radio serviceman and a five- or 10-buck tab.—*D. Houser.*

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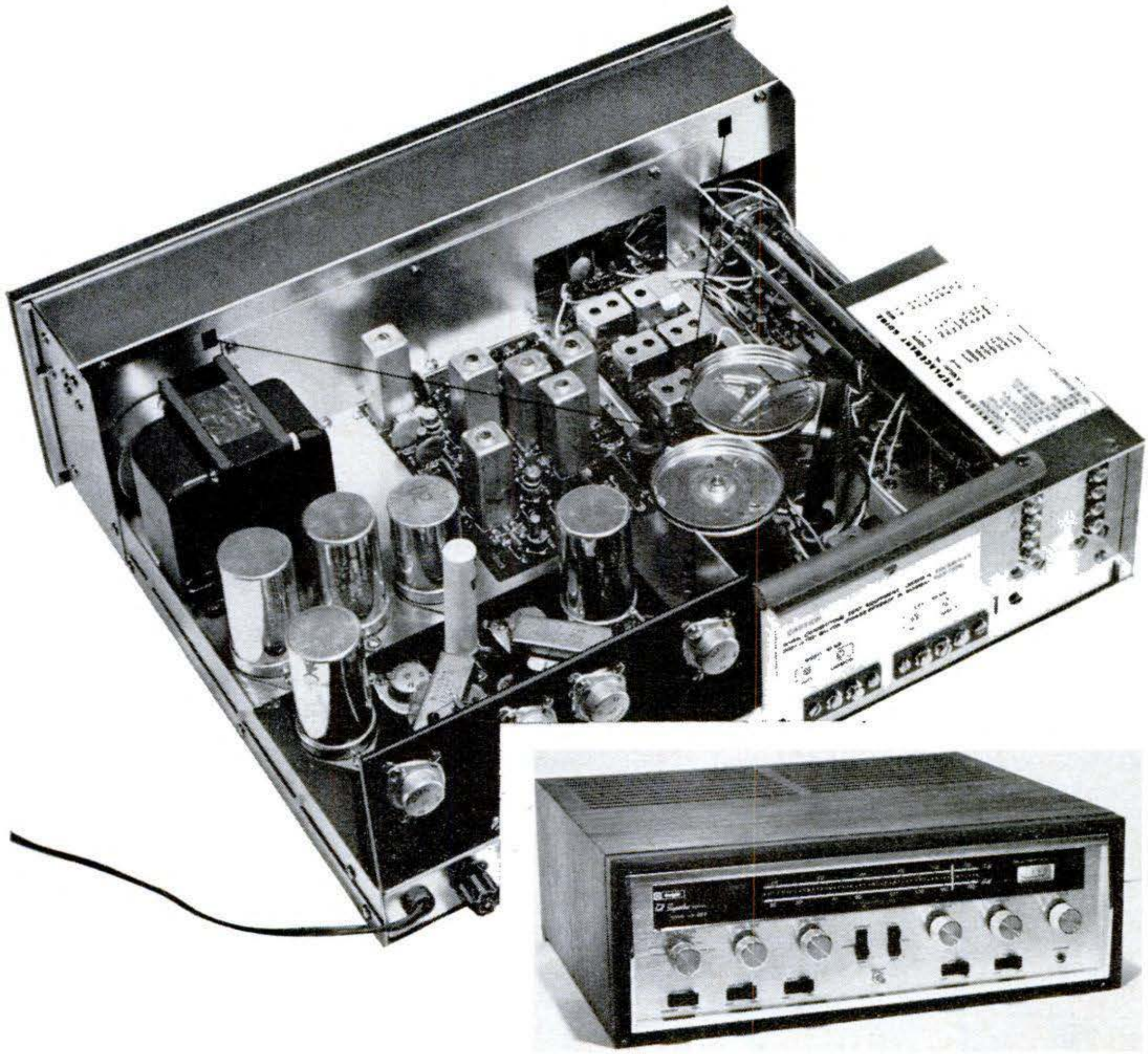
Can Build Just for Fun



KNIGHT Receiver

The top-of-the-line Knight-Kit KG-964 solid-state stereo receiver is big—in size, in sound, and in value. It consists of a preamplifier (with a complete control center), a 32-watt-per-channel stereo amplifier, and an AM-FM tuner, all mounted in a single chassis.

The sound of the KG-964 is unusually clean. Factory specifications peg distortion at below one percent, and it sounds it. I use the set in a steel-framed apartment building with only the built-in AM antenna and an FM antenna made of a couple of five-foot lengths of twin lead. Even so, reception on both AM and FM is good in my apartment.

The most interesting feature of the kit: You check for mistakes as you go along. Early in the construction, you mount a couple of terminal boards with strings of resistors on the chassis. As soon as you finish the power supply, you test it by hooking its output to the resistors, tapping it off and reading voltages on the built-in meter. If you get the right readings, you know everything is okay. Later, in the same way, you test the other circuit subsections.

Total assembly time is about 32 hours. The kit costs $190.—*C. P. Gilmore.*

Turn the page for more kits

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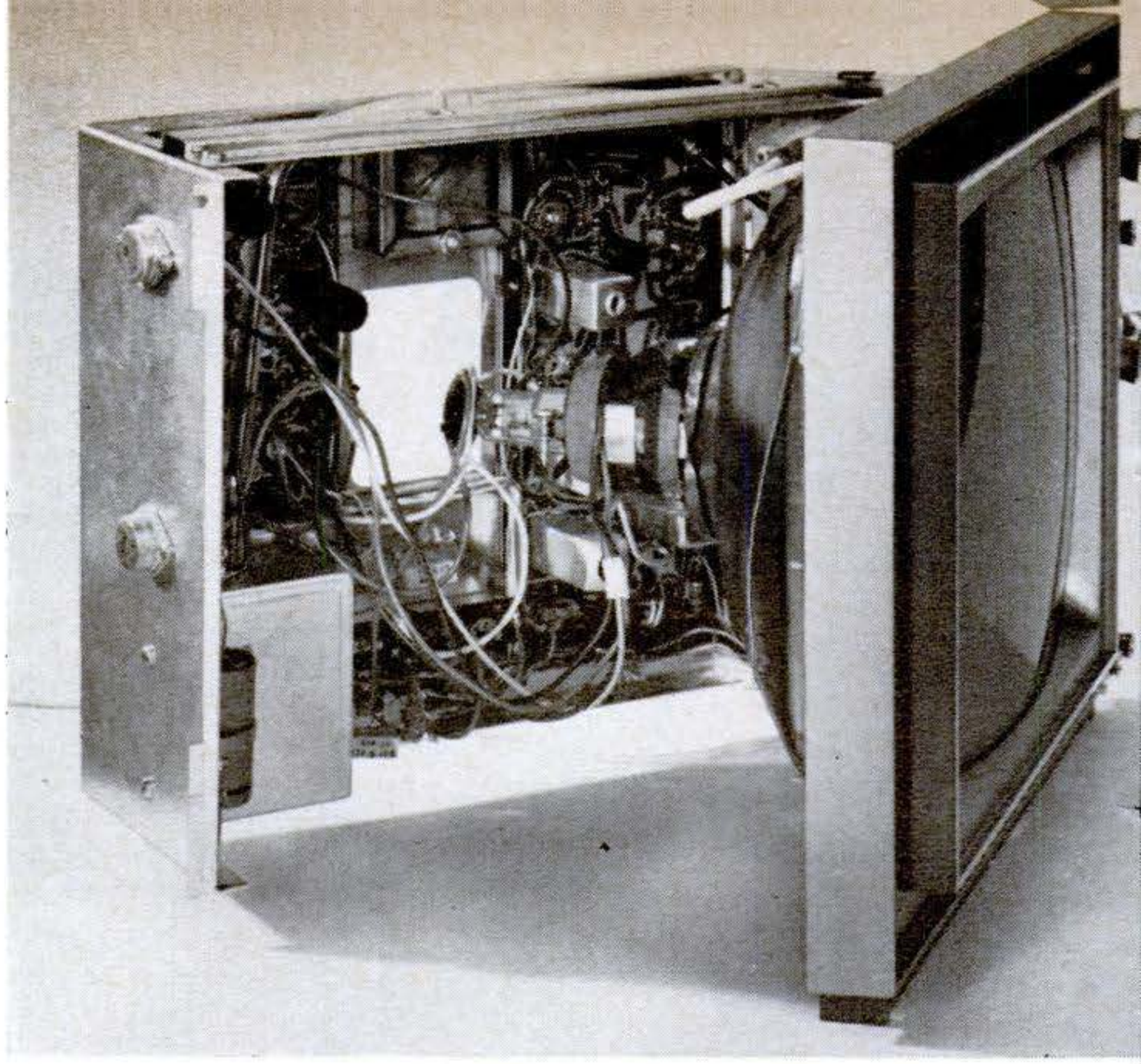
HEATH Carry-Around TV

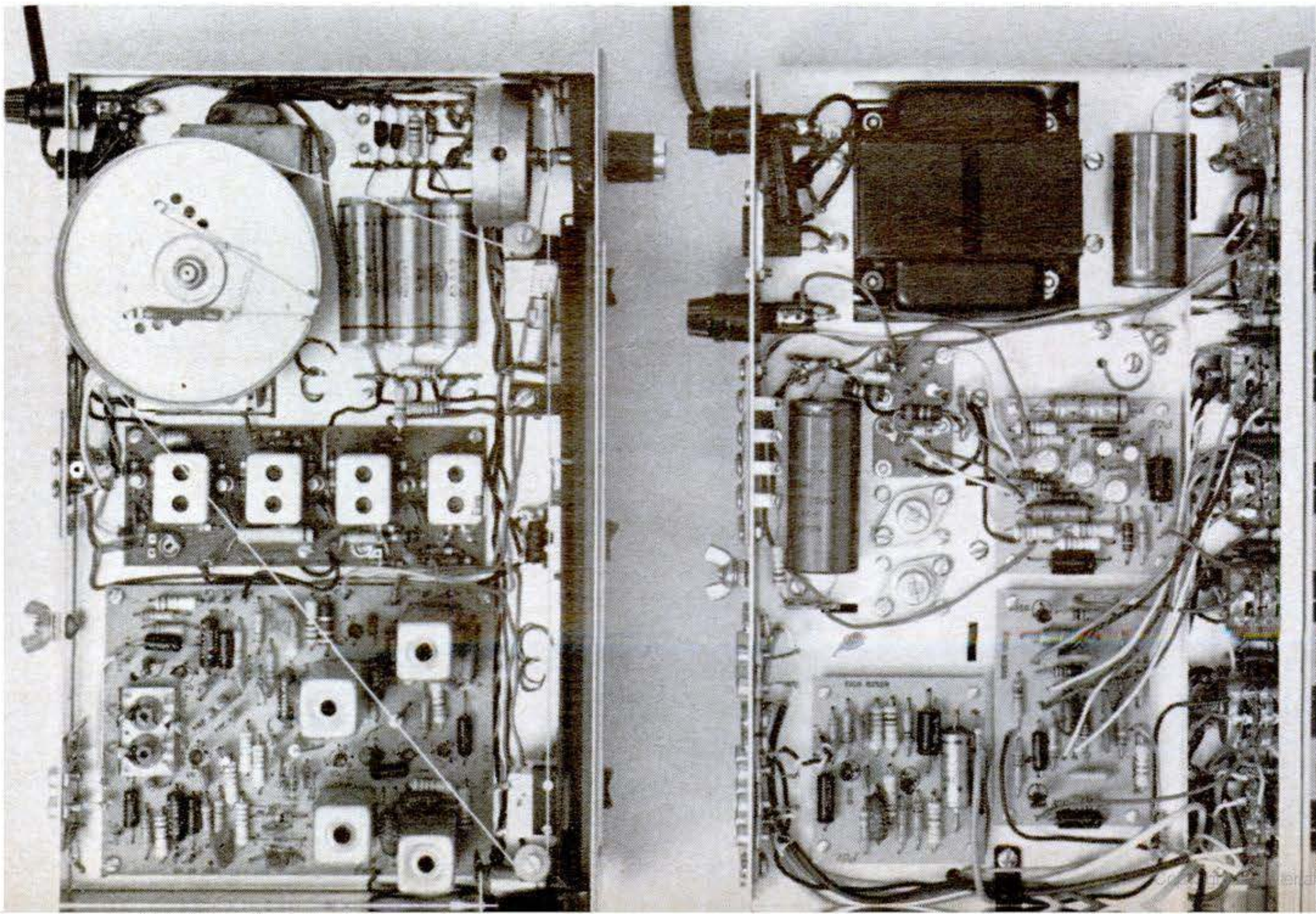


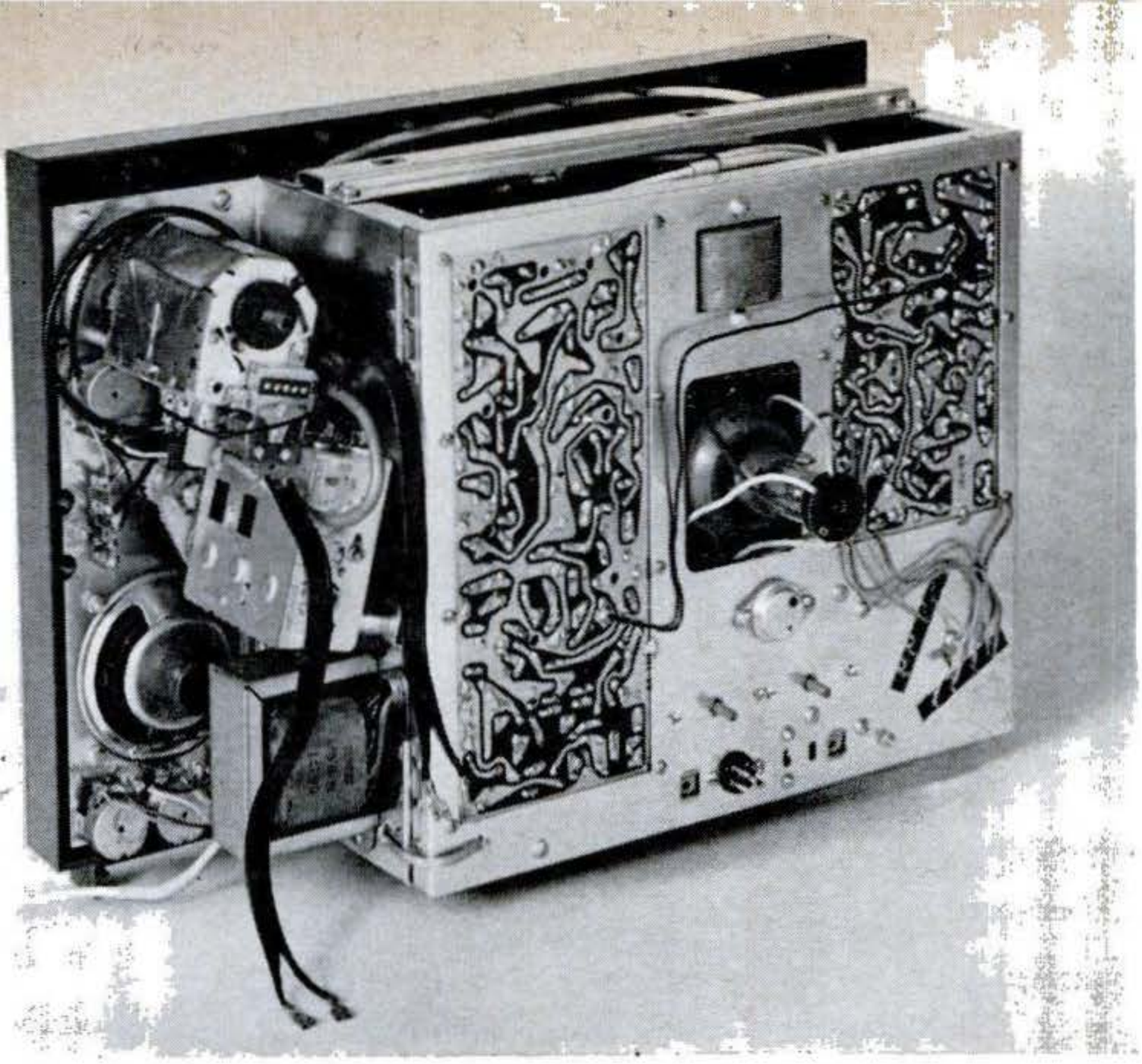
Here's a little solid-state black-and-white TV that's designed like a big-screen console. The Heathkit GR-104 12-incher uses the same kind of steel swing-out chassis (right) as big-screen Heath color sets. This all but eliminates hard-to-reach spots behind the chassis, and permits you to wire the set in 12 unhurried hours. Most of the circuitry is mounted on two printed-circuit boards that fasten to the chassis (left photo, facing page). Interconnections among the boards and other components are via a preformed wiring harness.

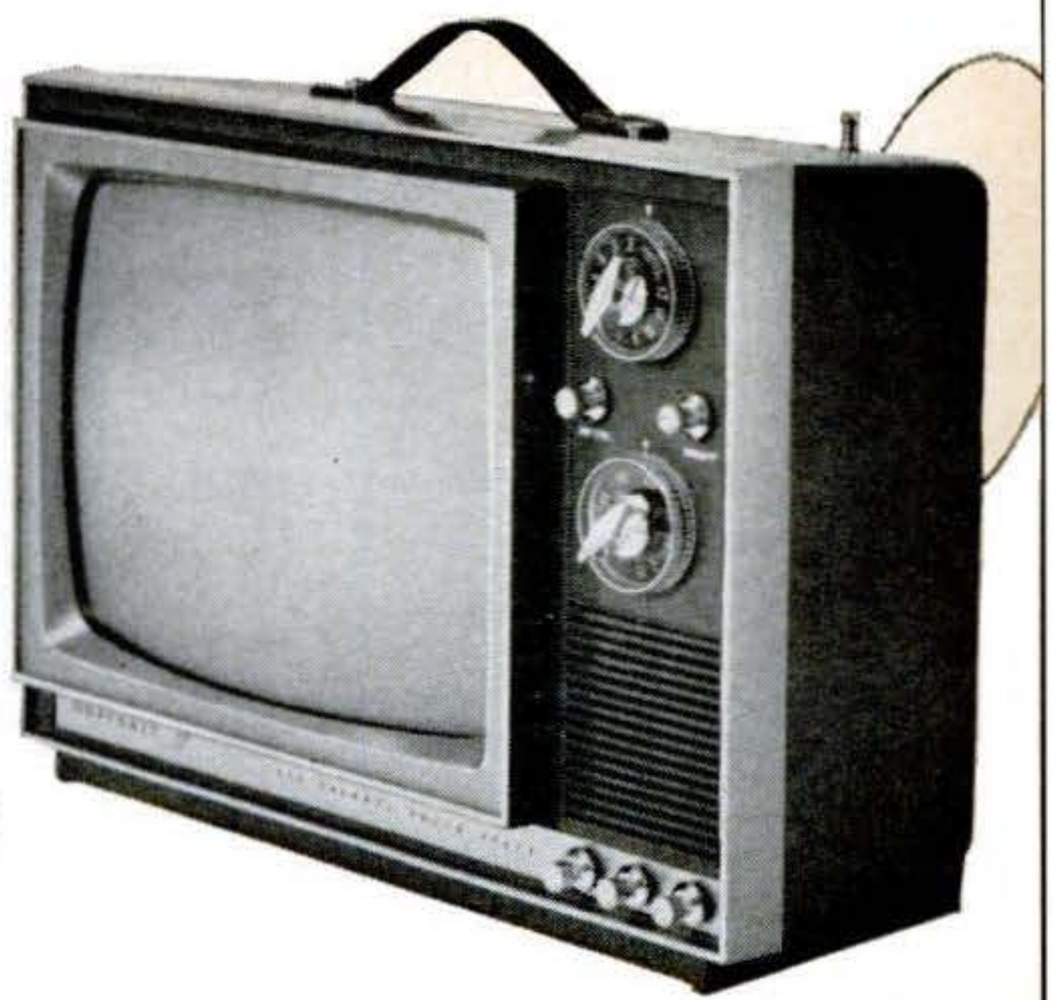
The GR-104 is the first kit-built consumer electronics device that uses an integrated circuit, or IC. This collar-button-size component replaces 12 transistors, 12 diodes, and 15 resistors in the set's sound stage.

How does it perform? Picture quality is up to the par of any ready-wired carry-around TV. The sound isn't bad but, as you'd expect, not too much bass comes out of the small (three-inch) front-panel speaker. There's ½ watt of audio output power—enough to drown out background noise when you use the set outdoors.

This brings up another feature: The







TV circuitry in this set incorporates 24 conventional transistors, 13 diodes, an integrated circuit, and the picture tube. The set weighs about 25 pounds.

set's built-in power supply will operate on 117-volt AC house current as well as 12 volts DC. Thus, your car or boat battery can run the set outdoors. And Heath offers an optional ($40) factory-wired, rechargeable battery pack that fastens to the cabinet bottom. A full charge will power the set for about six hours; the batteries recharge automatically when the set's 117-volt power cord is plugged into a house outlet.

A happy convenience is the "instant-on" feature. When the set is plugged into an AC outlet, the picture-tube filament receives half its normal voltage with the switch in the "off" position. This eliminates the usual warm-up period.

The only problem I encountered: It took a lot of fiddling with height, linearity, vertical, and horizontal controls to get a good picture when I first turned it on. Kit price: $120.—*Hubert Luckett.*

EICO Amplifier and Tuner

The EICO Cortina all-solid-state stereo amplifier and multiplex FM tuner are low-cost audio components that look, and sound, like high-cost components. Both kits go together quickly, although their obviously tight chassis layouts (see photos at left) demand that you work neatly and cautiously. The extra care is worth it, though, since the pair's attractive low-silhouette styling—each is only 3⅛ inches tall—makes it easy to install them almost anywhere without upsetting your wife's decorating scheme.

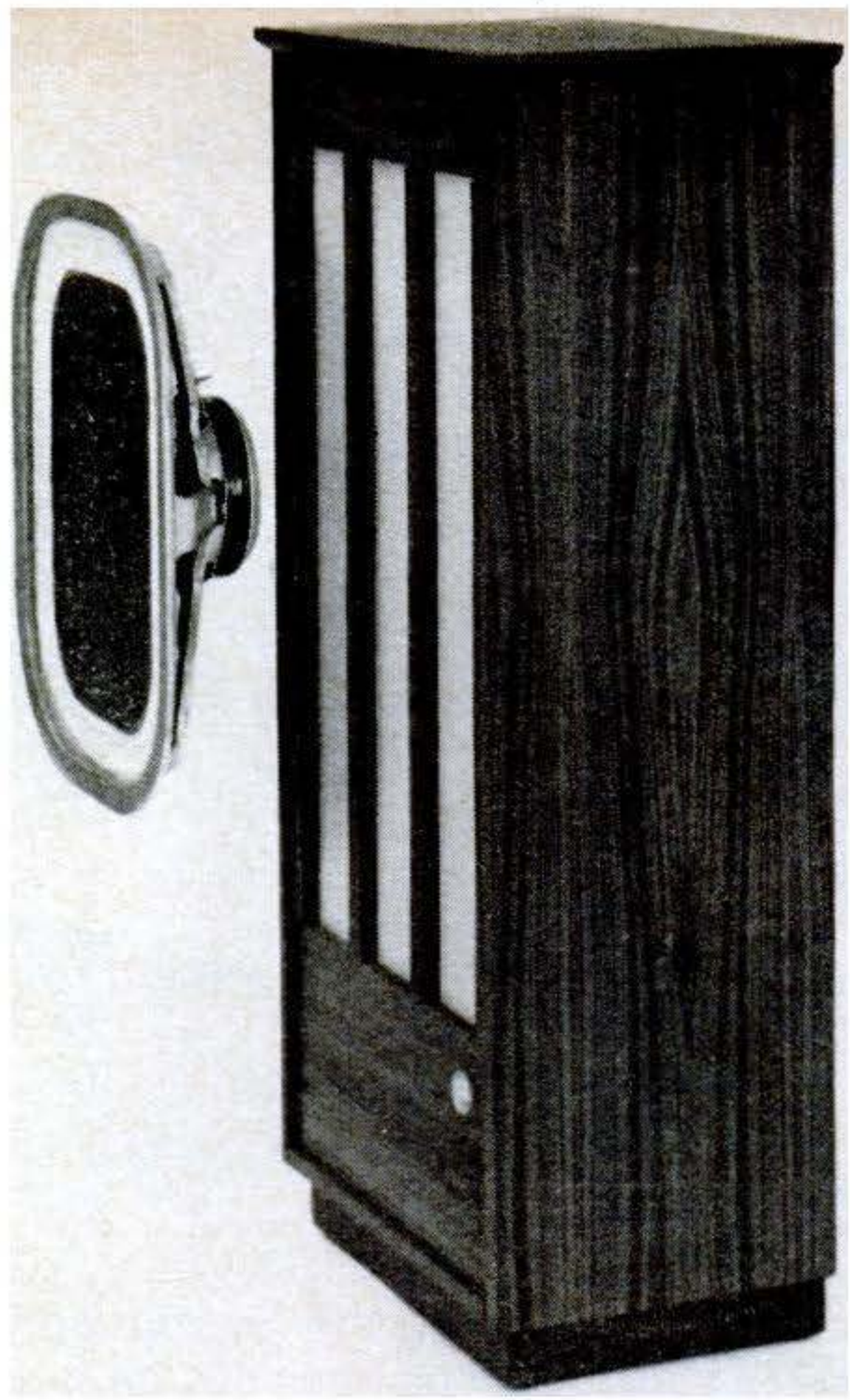
The model 3070 amplifier can deliver 15 watts per channel, continuous power, into an eight-ohm speaker, with negligible distortion. That's more than enough power for listening, unless you're driving big acoustic-suspension speakers.

The model 3200 multiplex FM tuner has adequate sensitivity for good fringe-area stereo reception. All of its critical circuitry—including the front-end and multiplex circuits—are supplied prewired. Each kit costs $90.—*R. Meyer.*

WHAT'S NEW

ELECTRONICS

This square-cornered hi-fi speaker makes big round sounds



There's nothing new about out-of-round loudspeakers—oval speakers have been standard equipment in car radios for years. But here's a superfidelity multispeaker system equipped with a *rectangular* woofer. The big advantage: You can fit a rectangular speaker, with almost twice the air-moving surface of a conventional round model, into a given cabinet size. Thus, the big-bass sound qualities of a large round woofer can be duplicated without the need for an enormous enclosure.

The rectangular woofer is also unusual in that its air-moving surface is made of expanded plastic foam, rather than the usual paper, fiberglass, or aluminum.

The system, called the ADC-18, costs $195. It's made by Audio Dynamics Corp., New Milford, Conn.

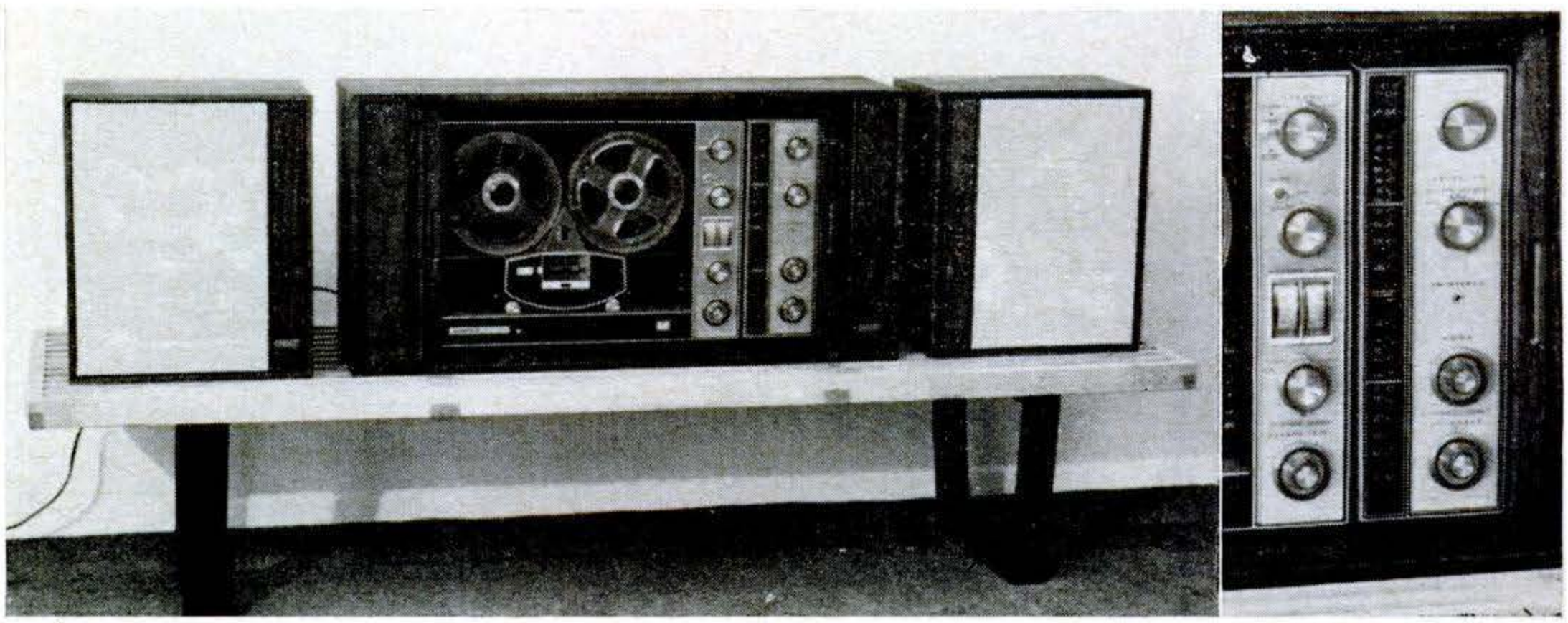
A music center that helps you build your own recorded tape library

The Ampex 935 Music Center is an elegant piece of walnut furniture—complete with sliding tambour doors—that's scarcely larger than a tape recorder. But packed inside is a fully automatic four-track stereo tape machine, a 15-watt solid-state stereo amplifier, and a transistorized AM/FM stereo tuner. All are tied together by a versatile set of controls (photo below, at right). Add the optional pair of matching speakers (Model 835) shown below and the 935 becomes a complete stereo sound system.

The unit is particularly adept at recording FM stereo broadcasts off the air since the tape machine is always at standby readiness when the tuner is playing through the amplifier. If you hear a selection worth recording, you can put it on tape at the touch of a button. The system also can be used as a conventional stereo tape recorder: It has two front-panel mike input jacks.

The tape deck used in the 935 reverses automatically when the tape runs out, or when you flick a front-panel lever. The unit has dual playback tape heads, so that you never have to flip the reels over to play the reverse side of the tape: One head works when the tape moves from left to right, the other when it moves from right to left.

The 935 costs $600, plus $100 for the pair of 835 speakers. It's made by Ampex Inc., Elk Grove Village, Ill.



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This month's question for the Ask-Our-Computer service

How Much Will My New Driveway Cost to Build?

PS's giant electronic brain will figure out the cost of your new concrete driveway, patio, or sidewalk. Here's how

Planning a concrete project this summer? A new driveway—a backyard patio—a sidewalk? If you do the job yourself, the cost of labor will be measured in terms of elbow grease. But what will the materials cost? Will it be cheaper to have ready-mix concrete delivered by a truck, or should you buy sand, cement, and aggregate, and mix the concrete yourself?

PS's new electronic computer will do the figuring for you and give you the low-down on price. Here's how our Ask-Our-Computer service works:

Mail us a stamped, self-addressed, legal-size envelope, and we'll send you a questionnaire to fill in with the dimensions of your planned concrete project, and the unit costs of raw materials in your area.

When you return the completed questionnaire with a $1 service fee, our programer will feed the information into the computer ["I Lived With a Computer . . . and So Will You," PS, May, explained how].

The computer is programed to calculate the quantity of concrete necessary for the specific project, and then to estimate the costs of various concrete mixtures. Finally, the computer figures the cost difference between delivered ready-mix and home-mixed concrete.

The answer sheet we'll send back to you will list the results of all these calculations, so you'll have all the information you need to make a sound buying decision before you go shopping.

Send your stamped, self-addressed envelope to Ask-Our-Computer, Program #3, POPULAR SCIENCE, 355 Lexington Ave., NYC 10017.

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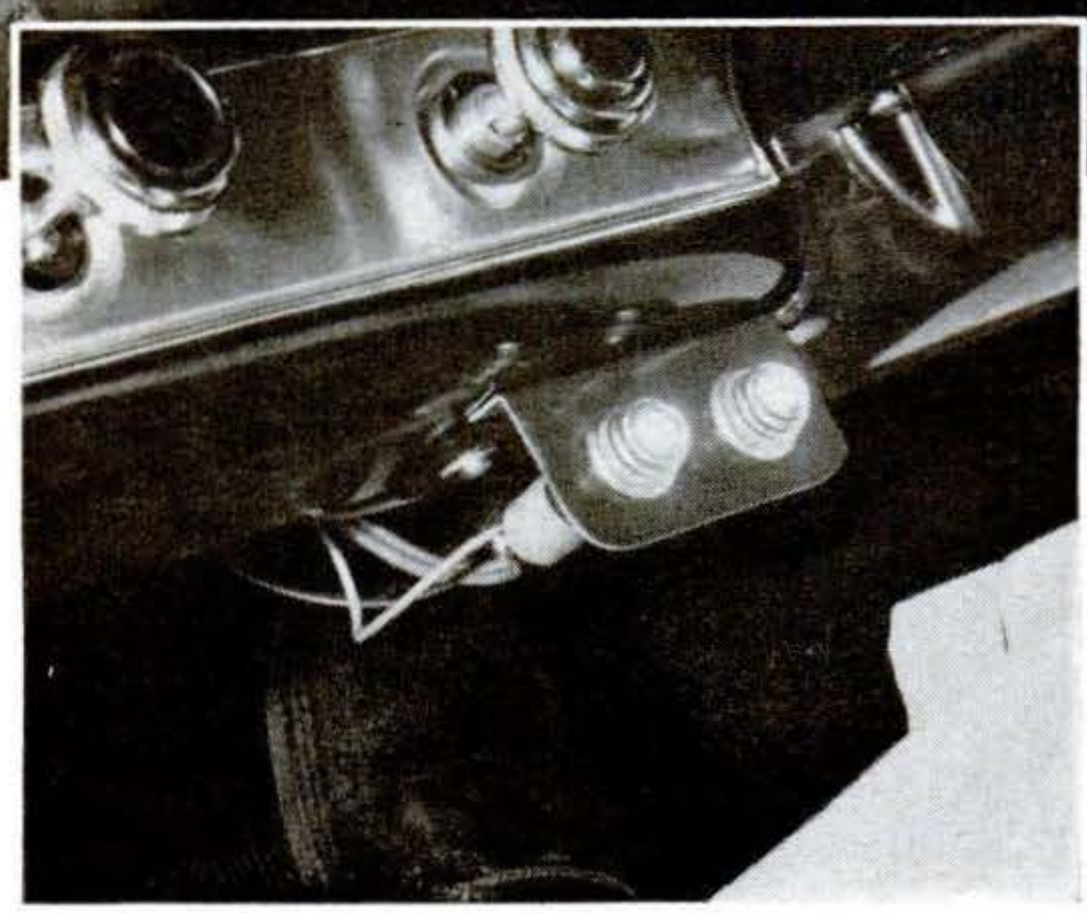

NORMAL

When all brake lights work perfectly, the two dash-mounted indicator lights (inset photo at left) glow brightly. At night, the same two pilot lamps glow at half intensity to indicate that the left and right tail lights are lit. This is more than enough brightness to be visible, but not enough to be distracting. Thus, during daytime driving, the indicator lights change from dark to full brightness every time you step on the brakes; at night, they switch from partial illumination to full brightness.

A Telltale for Your

This simple gadget tells you, at a glance, whether or not the rear lights are working

By HENRY ZAVE

No doubt about it—your car's tail lights and stop lights are often all that stand between you and a rear-end collision when you drive at night or through low-visibility conditions.

That's why I installed this simple rear-light monitoring system. A glance at the system's two signal lights—mounted in a below-the-dash bracket—tells me instantly whether or not the tail and stop lights are working properly.

How it works. Heart of the system is a bank of four homemade reed relays that monitors current flowing to the rear lights. Each relay consists of a coil of 26-gauge Formvar-coated magnet wire around a glass-enclosed switch.

A reed switch is little more than two thin metal rods held parallel, and almost touching, inside a pencil-thin glass en-

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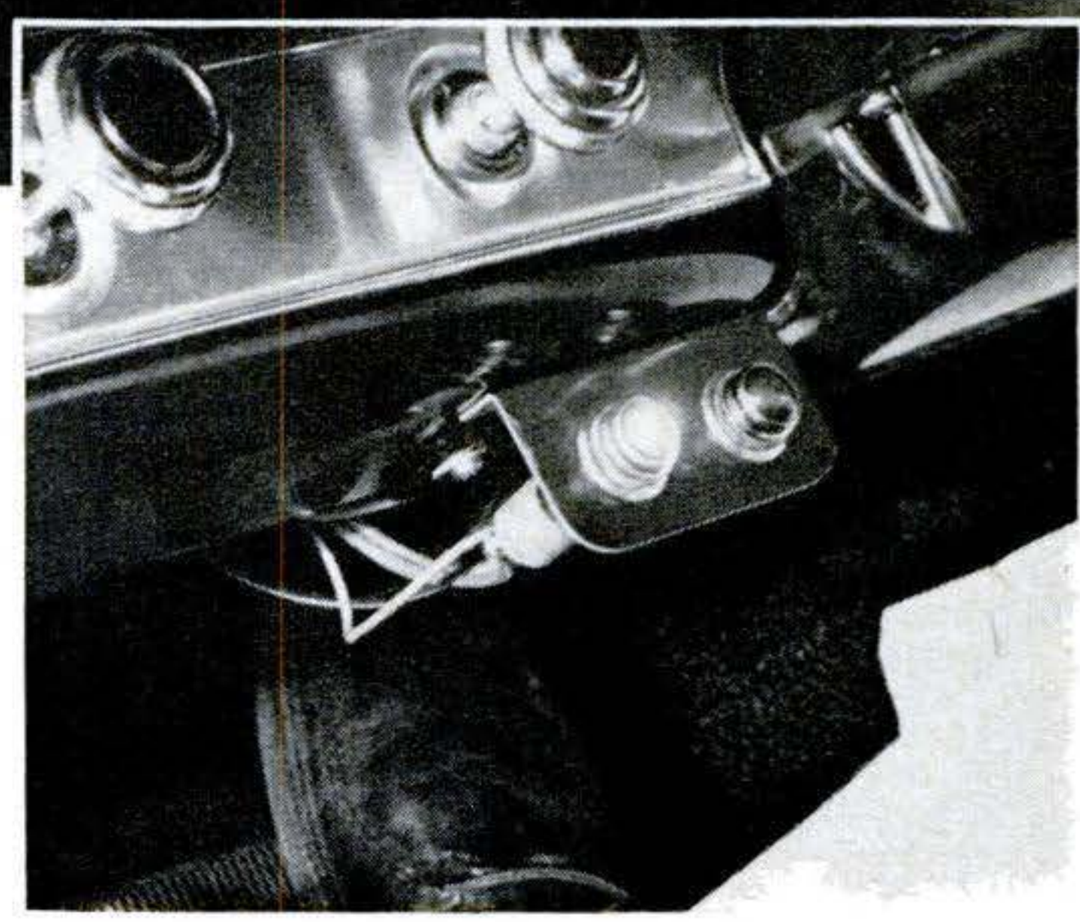

ABNORMAL

With the right brake light out, only the left dash-mount pilot lamp lights up when the brake pedal is depressed. The system will warn of a faulty tail light in the same way: One of the indicator lights glows at half brightness. The system will detect a wide range of electrical-system faults besides burned-out light bulbs. The pilot lamps won't light normally if your car's brake-light switch is broken, or if a bumpy road has jolted a connector loose, or if a frayed wire has caused a short circuit.

Car's Tail Lights

velope. When the switch is placed within a magnetic field, the two metal rods snap together and close the circuit.

The coil of wire wrapped around each reed switch acts as an electromagnet that closes the switch when energized.

Relay RL2's coil is inserted in series with your car's left tail-light filament (or filaments if the car has multiple rear lights on each side). If the filament lights normally, current flows through the coil; the resultant magnetic field closes RL2's reed switch, and the left indicator signal light, PL1, lights up. However, because resistor R2 is wired in series with the reed-switch contacts, PL1 only lights to approximately half brightness.

On the other hand, if your car's left tail light doesn't light, for any reason, then PL1 will not glow at all.

Relay RL1's coil is wired in series with the left stop-light bulb (or bulbs). When it lights, RL1's reed switch closes, and also turns on indicator light PL1. However, there is no resistor in series with this switch, so PL1 lights to full brightness. Since in almost all U.S. cars the stop-light bulbs are also used in the turn-indicator system, PL1 will flash on and

Continued

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off when you signal for a left turn during the day, and will flash between half and full brightness when you signal at night.

Relays RL3 and RL4 work in the same way to monitor the right lights.

Building it. Make the mounting bracket for PL1 and PL2 from a piece of scrap aluminum. Paint it to match your dash.

To determine the correct number of turns for each relay coil, use this simple formula: Number of turns=160÷filament amperage.

For example, my car has a No. 1157 dual-filament bulb on each side. The stop-light filament of each bulb draws one ampere. Thus, RL1 and RL4 (the stop-light monitors) each require 160-turn coils (160/1=160 turns).

Each tail-light filament draws ½ ampere, so that RL2 and RL3 each require 320-turn coils (160/½=320 turns).

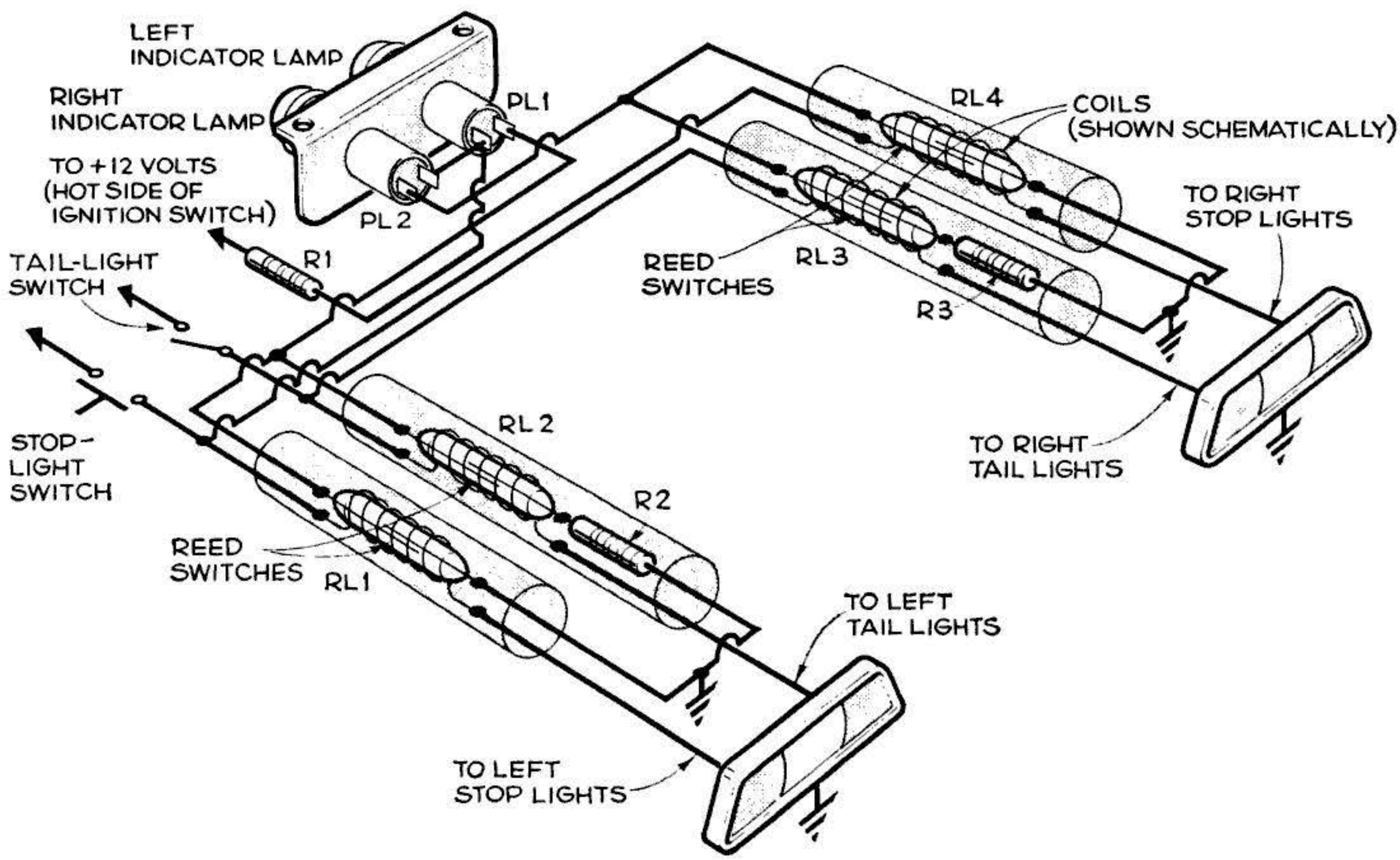
You can determine the current that your car's rear lights draw by actual measurement with an ammeter, or by consulting the light-bulb catalogue at your service station.

If you don't have access to this information, or to test equipment, experiment with the values given above. Add turns to the coils if the switch doesn't close reliably; subtract turns if the resistance of the coils dims the tail and stop lights noticeably, or if the coils get warm.

The reed switches are brittle, so handle them very carefully when you wind the coils on. Space the required number of coils evenly across each switch in several neatly wound layers.

Use No. 18 multistrand insulated cable to make terminal leads for the switch terminals and the ends of the coil windings. (To avoid confusion, use different color cable for the switch leads and the coil leads.) You can use No. 18 stranded cable, or ordinary lamp zip cord to connect the relay assemblies to the indicator lights PL1 and PL2.

For protection, tape the completed relays with several layers of electrical tape, and then center them inside short lengths of ½"-inside-diameter copper tubing. Seal the open ends with epoxy cement. PS



PARTS LIST

R1—5.6-ohm, 1-watt carbon resistor
R2, R3—68-ohm, 1-watt carbon resistor
Reed switches (4 required) GE type DR101
PL1 and PL2—Dialco 812210-111-102 low-voltage pilot-light assemblies.
For a 12-volt electrical system install type 1815 pilot lamps in the assemblies. For a 6-volt electrical system use two No. 47 bulbs.
Misc.—½"-inside-diameter copper tubing; No. 26 magnet wire (Formvar or Beldenamel); No. 18 stranded insulated cable; electrical tape; hardware.
Note: All electrical components are available from Allied Radio Co., Chicago 60680. Copper tubing is available at any plumber's supply shop or hardware store. The estimated total cost of system: under $15.

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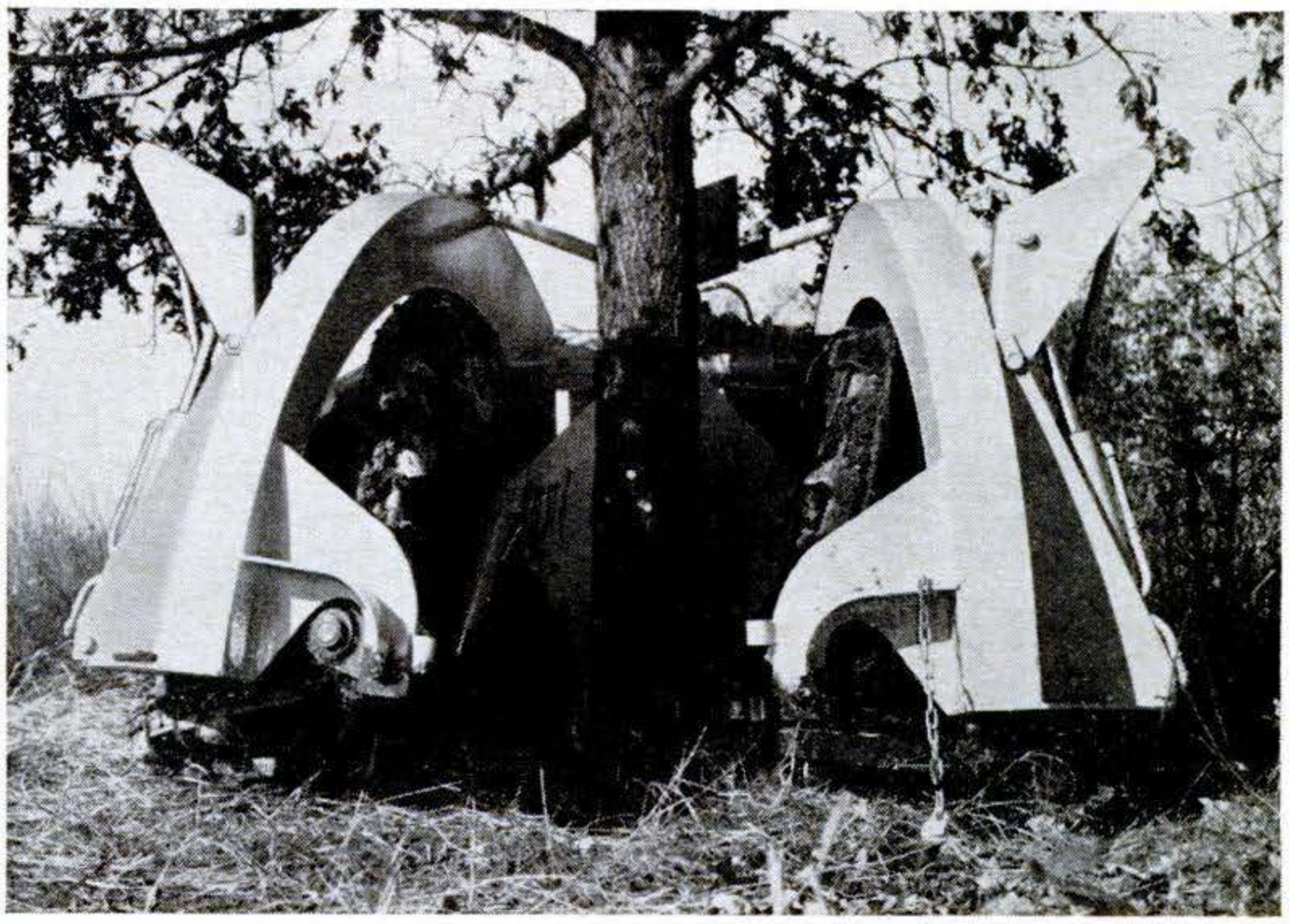
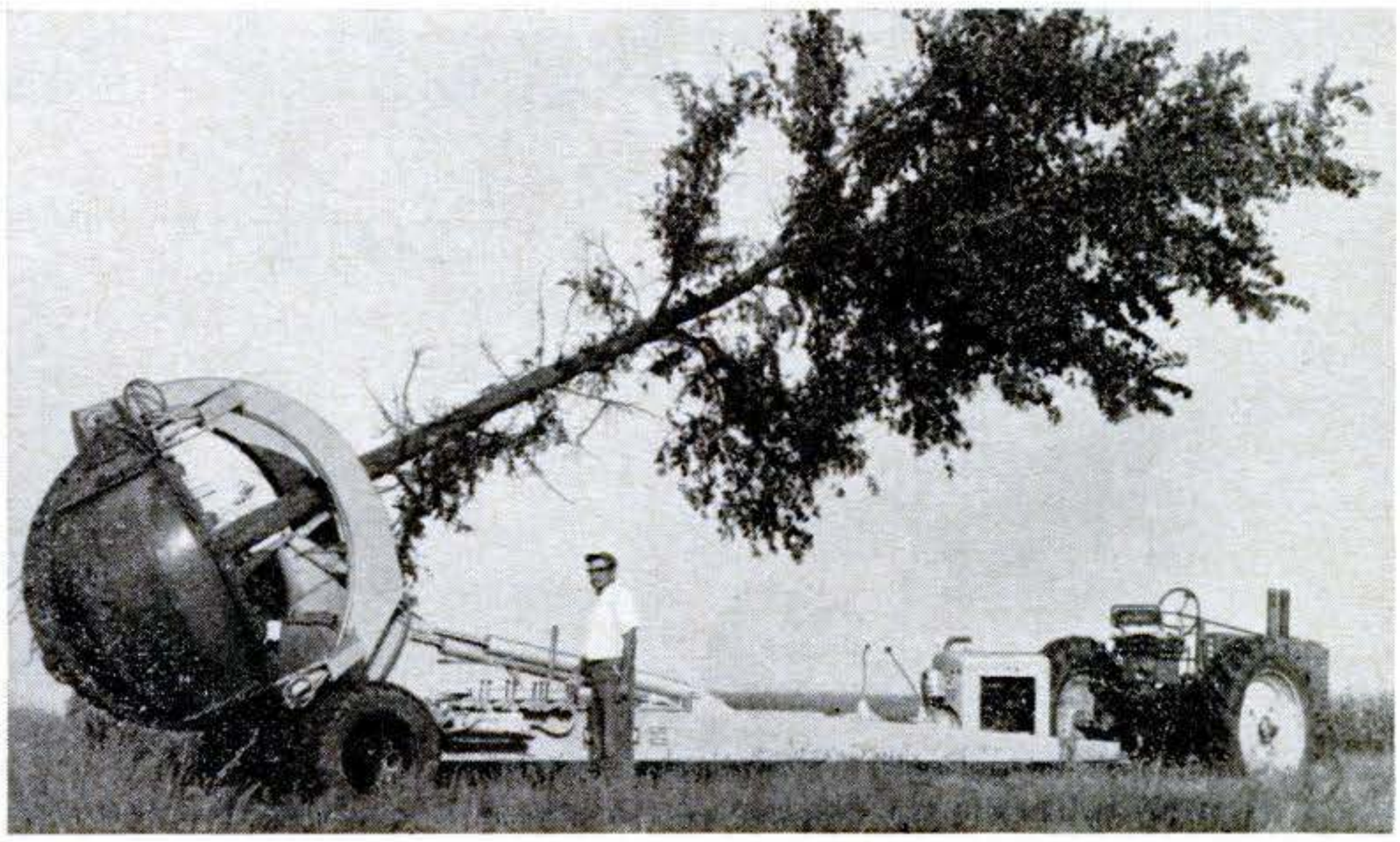
Want "instant shade"? Well, here's how

That crazy-looking contraption at right is a brand-new way of transplanting trees for "instant shade." Heretofore, nurserymen had to dig and sweat to expose the root system, then "ball" the soil and roots. Digging the new hole was just as hard.

The "Tree Mover" (made by Vermeer Mfg. Co., Pella, Iowa) can neatly carve out a ball, and lift a tree in minutes. Two hydraulic cutting cups dig a hole seven feet in diameter and 40 inches deep. It isn't even necessary to wrap the ball in burlap—the cups keep it intact. Replanting is just as simple, and the hole is just the right size.



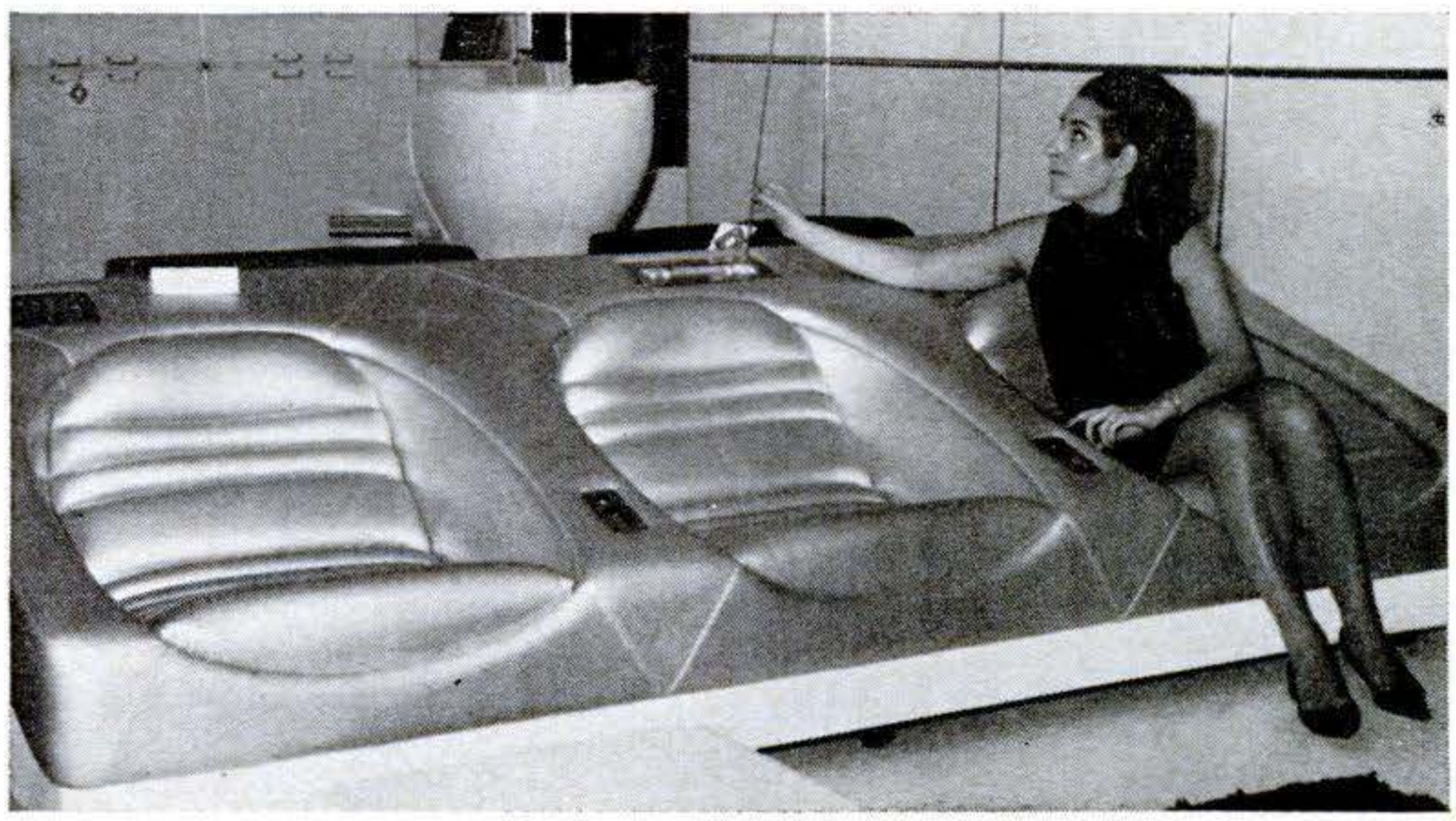
Tree Mover takes a big bite to transplant trees with eight-inch-thick trunk.



Cups enclose "ball" as tree is loaded on trailer for removal to new hole.

Bucket seats? Try this modern sofa

Sooner or later it had to come—automobile "bucket seats" incorporated in sofas. And who but an Italian would do it? Designer of this piece is Gio Ponti, known as Italy's master of skyscrapers. Behind the lady is a radio, an ash tray, and, of course, as in a car, a cigarette lighter.



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Home-built boat hauler on one-ton-truck cab and chassis tows 31-foot trailer. Frame of angle iro

My Piggyback Boat Hauler

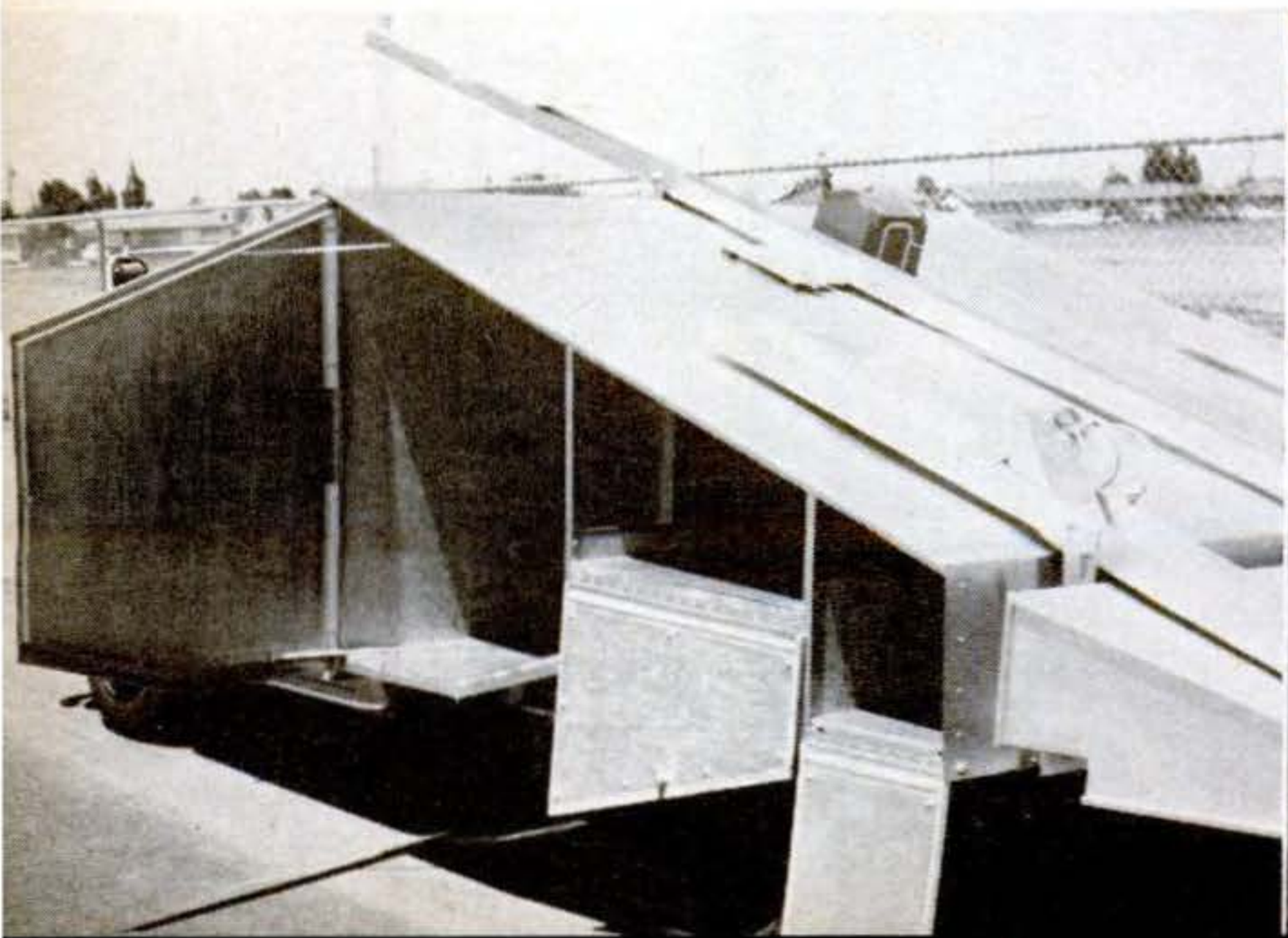
This strange-looking truck rig can put more fun in your travels

By F. A. BARNES

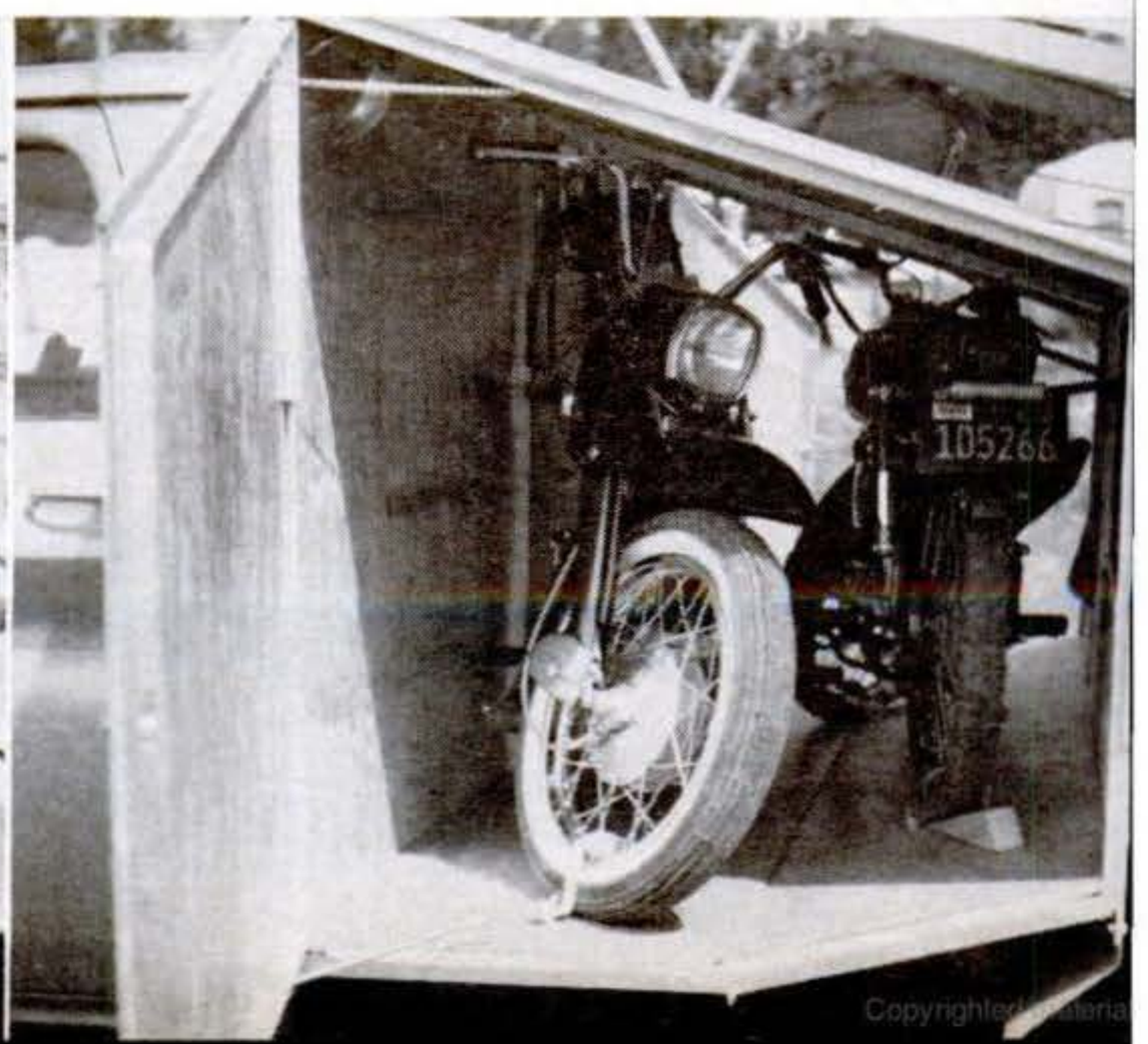
When you tow a travel trailer, you usually have to settle for a lightweight car-top boat that's inadequate for water skiing and too small for safe boating on large lakes and coastal waters. But I solved that problem with this piggyback truck rig I built.

Mounted on a one-ton-truck chassis, behind the cab, this outfit hauls a boat-trailer combo weighing 1,200 pounds and a 31-foot travel trailer. And to boot, it gives me plenty of extra storage room

Storage room for sports equipment and supplies is reached by access doors on each side of the truck.



Two small motorcycles carried in large front compartment come in handy for enjoyable side trips.



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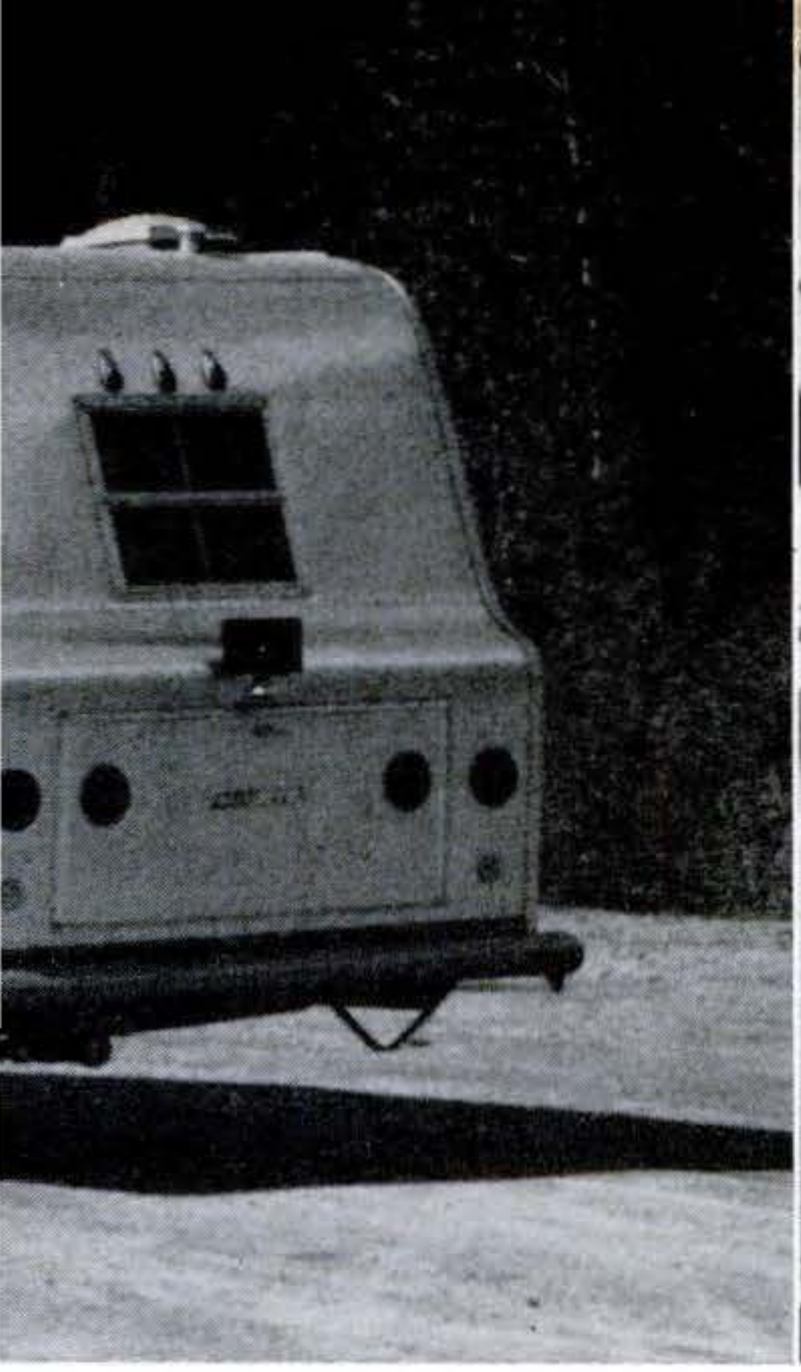
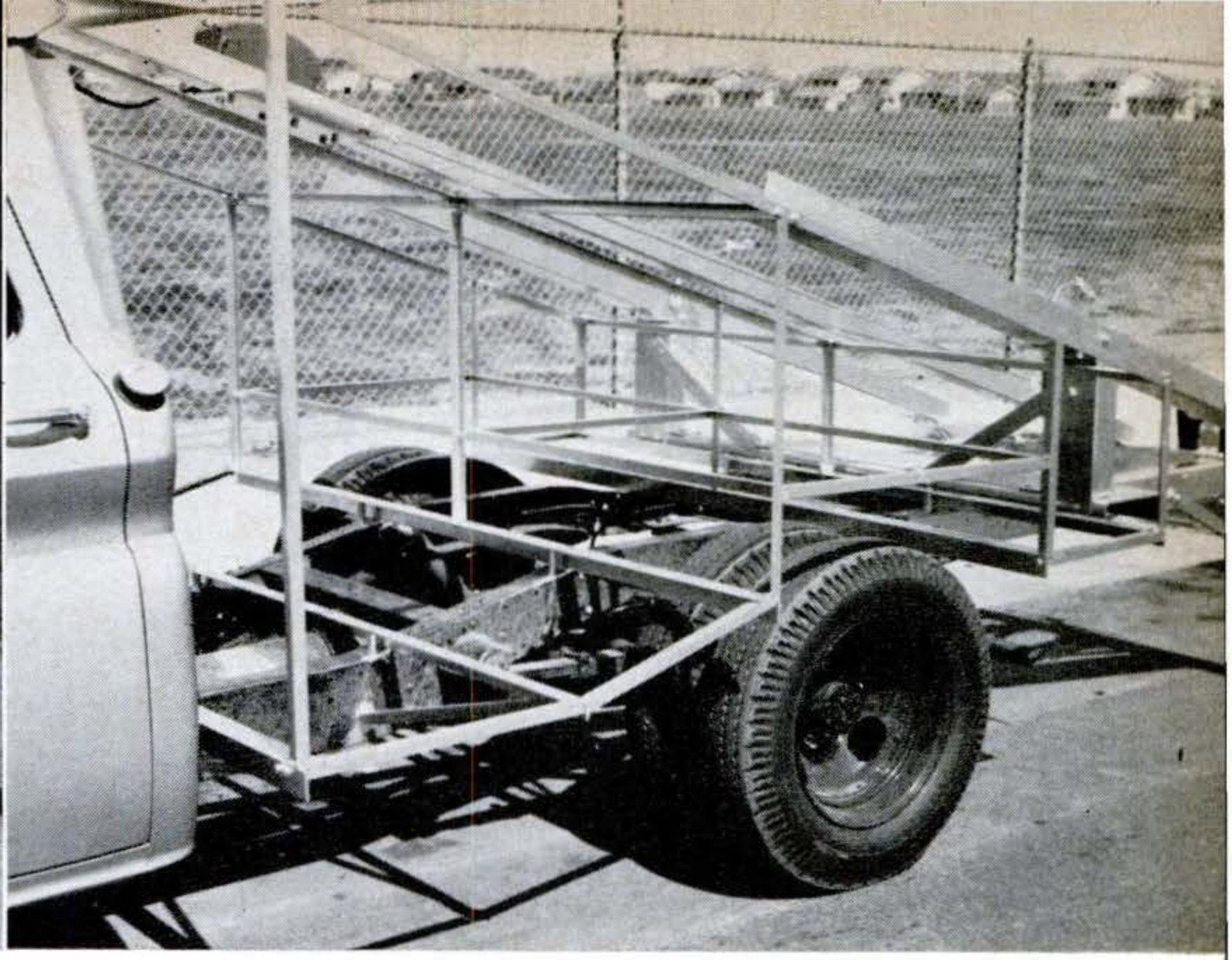




and channel steel at right supports boat and trailer. Storage compartments are below boat ramp.

Tows a Travel Trailer, Too

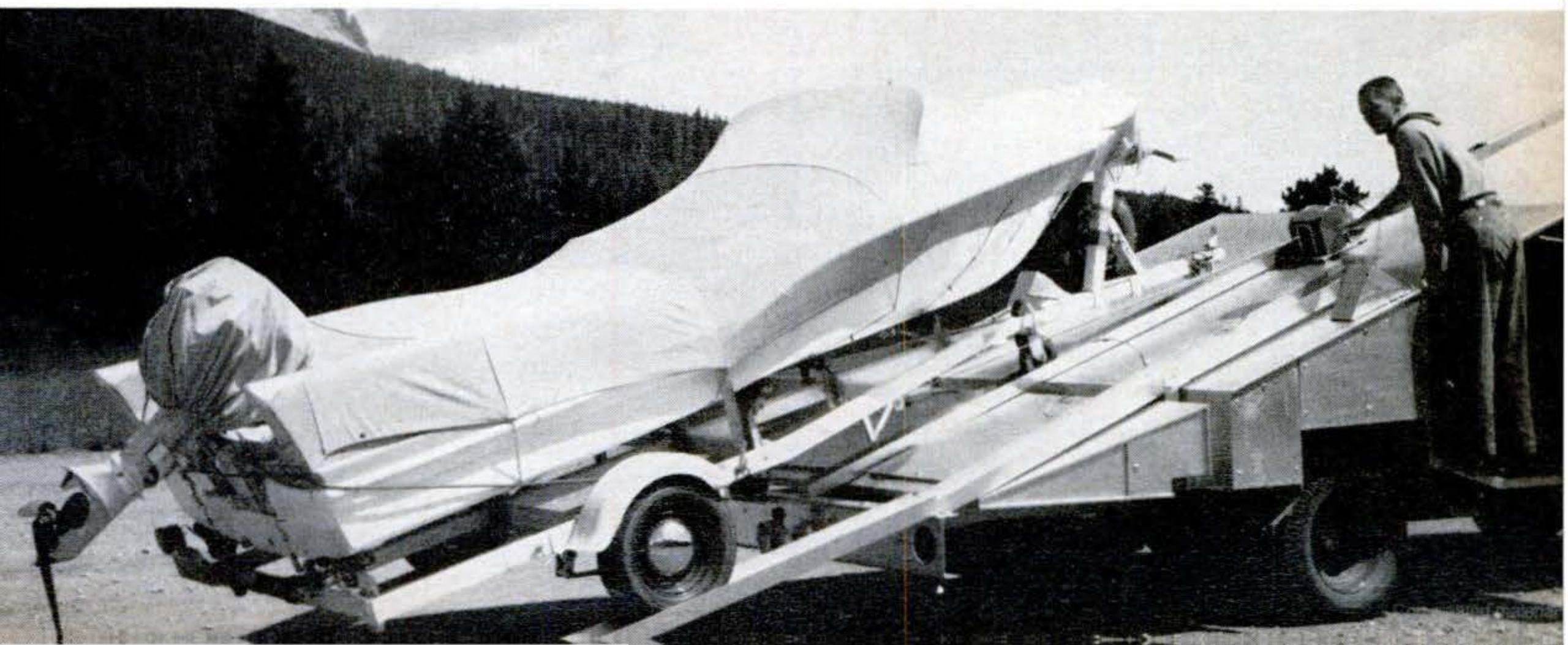
under the boat rack for sports equipment and camping supplies. At the campsite, I unhook the travel trailer and use the truck to launch the boat.

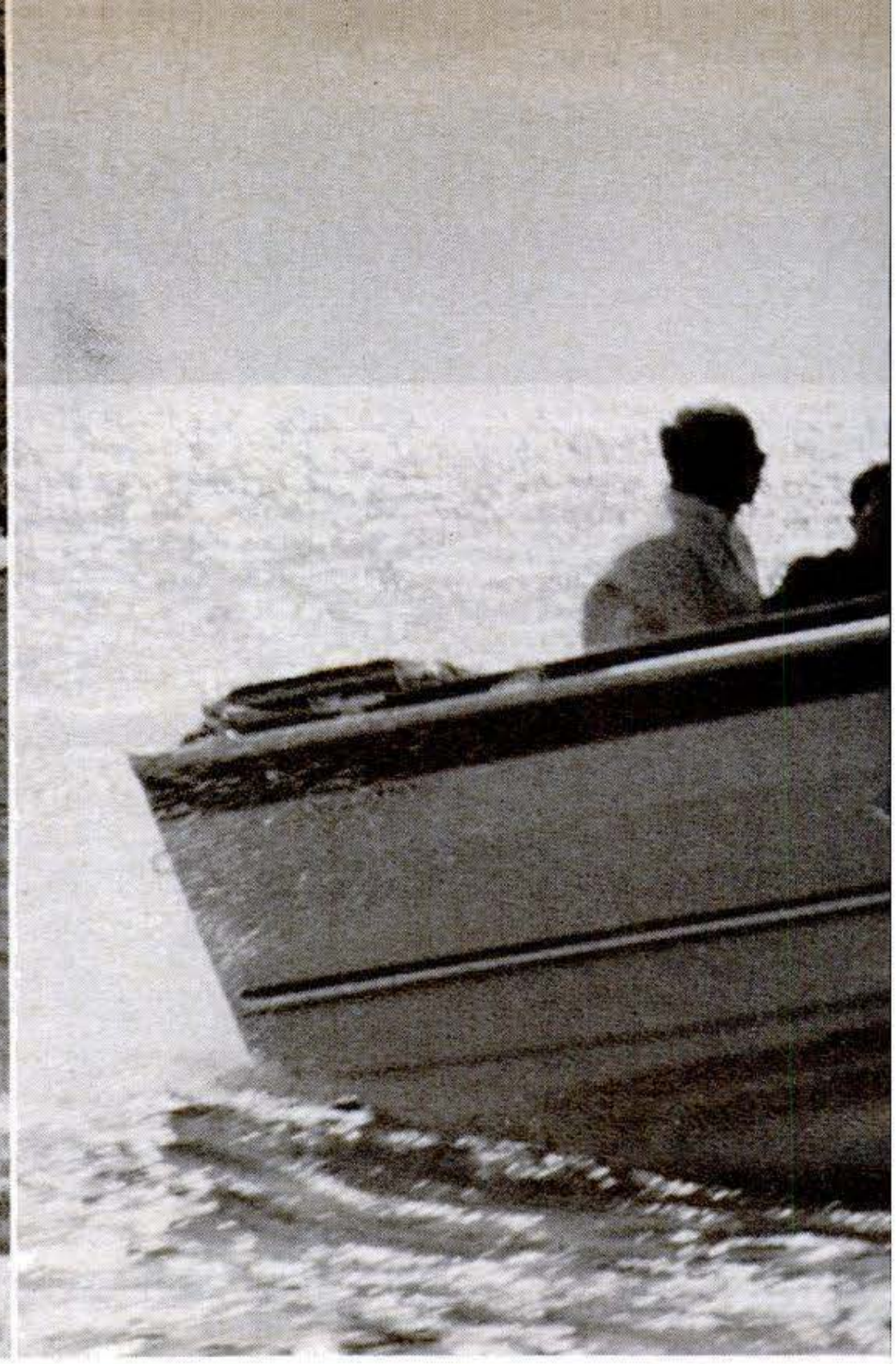
The boat rack is made from scrap construction steel and angle iron welded or bolted together. The storage cabinets are exterior plywood covered with sheet aluminum. Everything is coated with anti-rust paint to match the truck cab.

To load boat and trailer, I put down two channel-iron ramps and hoist them into place with a 12-volt winch run off the truck battery. The boat trailer is held by a ball hitch bolted to the end of the center beam, short steel cables from the wheel channels to the trailer axle and frame, and large wheel chocks. The winch cable adds support.

(If you'd like to build your own boat hauler, you can get information on plans and instructions by writing directly to the author: F. A. Barnes, Box 483, Sunnyvale, Calif. 94088.)

Loading the boat is easy. You put the two ramp rails in place, lift the trailer dolly wheel into the center channel, and the 12-volt electric winch pulls it up. Ramp rails store in the rear compartment.





With son Jim at the helm, we take a fast turn outside Avalon harbor at Catalina Island (left). Enroute

PS BOATING

Two Jim Roes

What does the "in" generation want in a boat? Jim Jr. lends a hand in testing the Charger

By JIM ROE SR. and JIM ROE JR.

It was a little after dawn, and we were standing side by side on the dock at Newport Beach, Calif. It was a day young Jim had been waiting for: Two identical-hulled Glasspar Commodore Chargers were to be put through their paces by two not-quite-identical Jim Roes.

Could two generations find happiness with the same boat? It was time to tune up and find out. The bad weather that had plagued the Pacific Coast for the past couple of days had cleared. We set our course for Avalon on Catalina Island, 26 miles out in the Pacific. Our plan was to take turns driving each of the two Glasspars. Though the hulls were identical, one was powered by a 155-hp. OMC stern drive, the other by a 160-hp. MerCruiser stern drive. The Charger, with an overall length of 20 feet, two inches, and a 94-inch beam can be bought with stern-drive power units ranging from 120 hp. up to 225 hp. Prices range from $4,495 to $5,592.

With a fair chop, we kept the convertible top and side curtains in place nearly all the way across the San Pedro Channel. At about 1,950 r.p.m. the Charger took the chop very well. But at slightly higher speeds we pounded uncomfortably. The seas were bumpy enough to rupture a fuel line in one of the boats.

In the maneuvering and speed tests off Catalina, and in the high-speed run back to the West Coast, 23-year-old Jim had his chance to show me what the younger generation really likes in a boat: speed and

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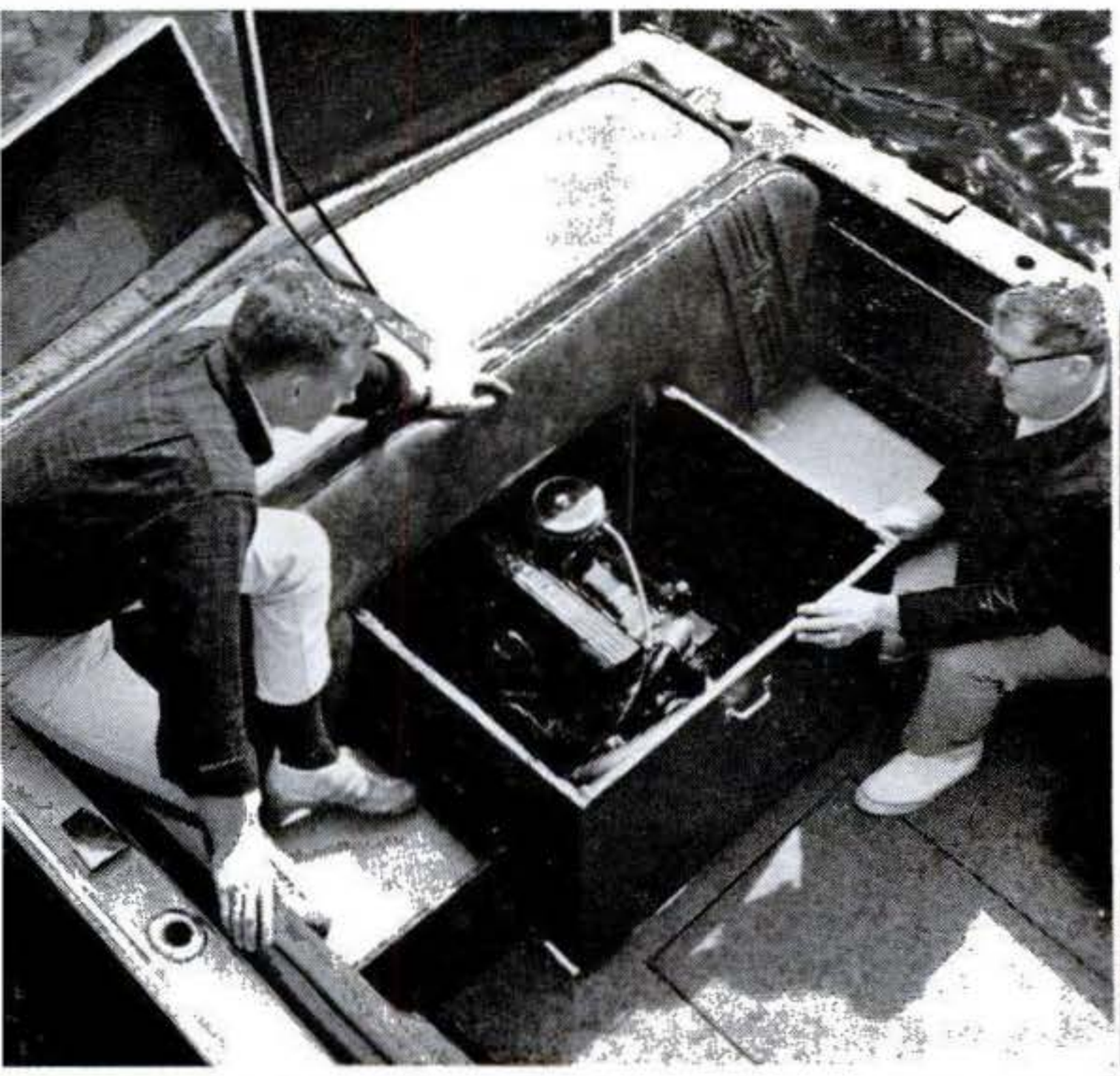
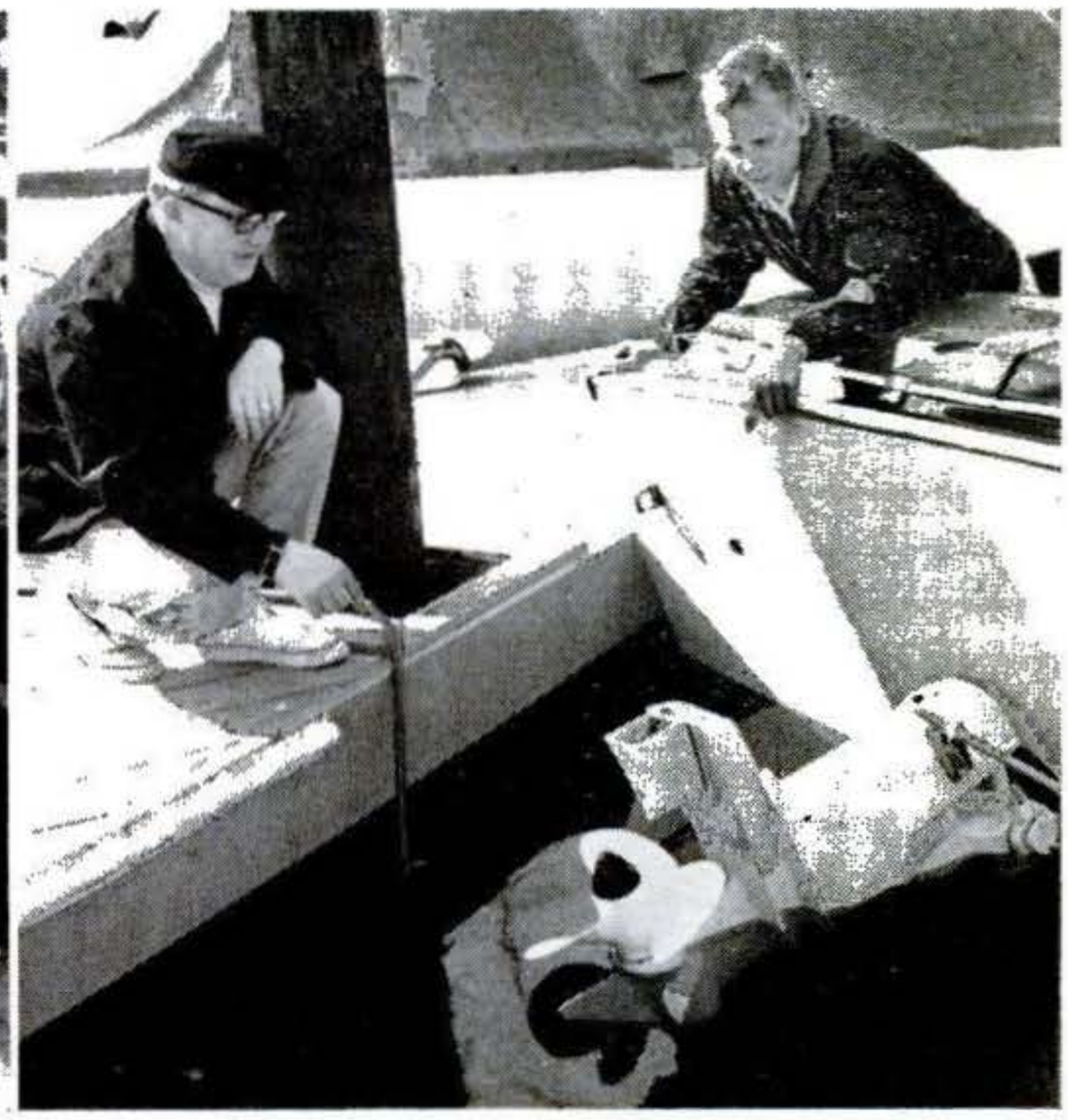
from Newport Beach, Calif., to Catalina, a choppy Pacific sent us on occasional short flights (above).

Test the Glasspar



MerCruiser 160-hp. stern drive powered one test boat. The Charger has lots of storage area. Full-width hatch astern of engine holds live-bait well, ice chest. There is storage space under cockpit deck.



An OMC stern drive of 155 hp. powered our other test hull. The hull alone weighs in at 1,600 pounds. Transom width is 88 inches. We both agreed that she's a rugged, tough-built, seaworthy craft.

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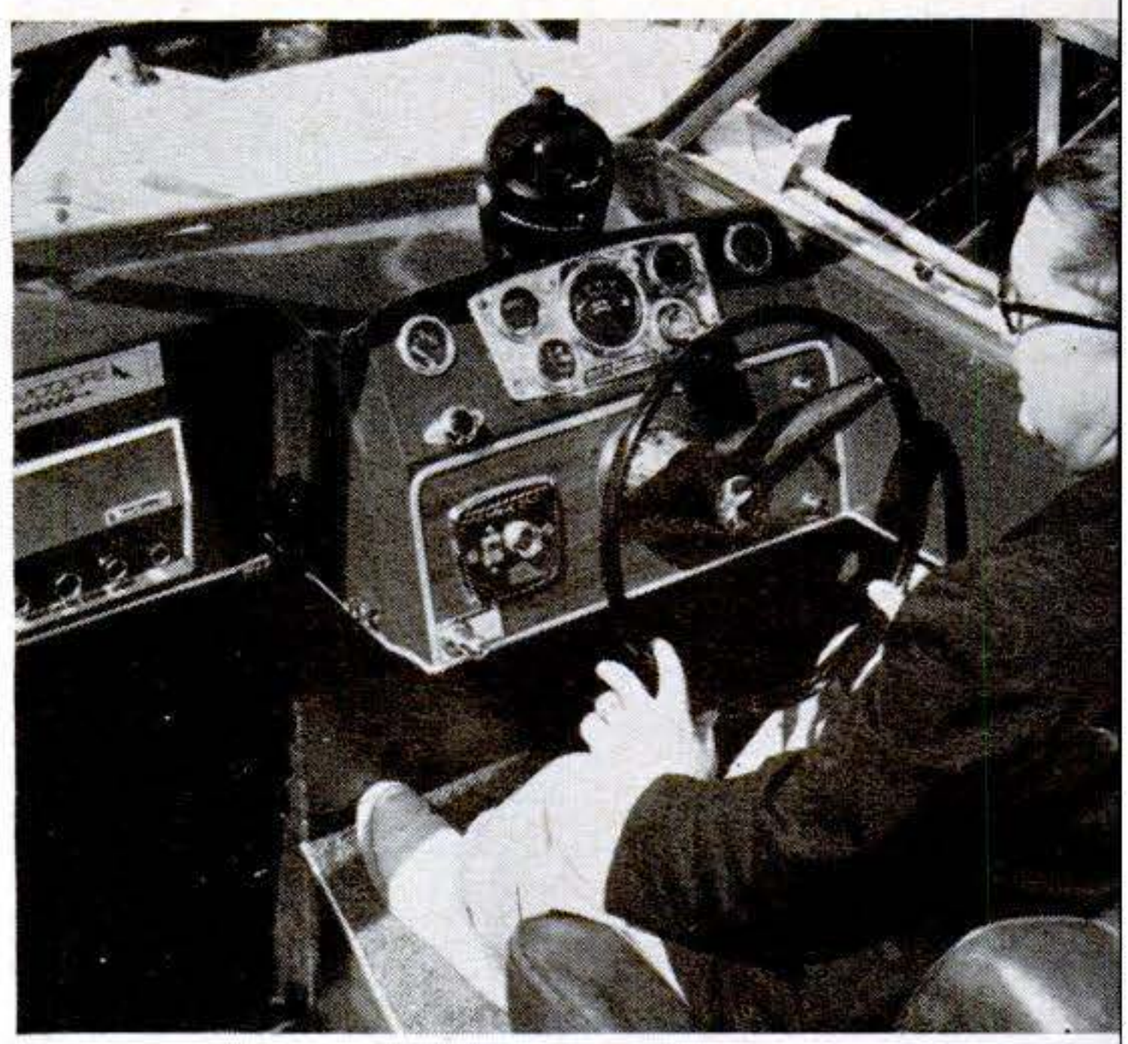
The boats pleased both the younger generation and the older one



Instrumentation, shown above, is well grouped. Visibility from the driver's seat is exceptionally good. Here radio telephone is conveniently flush-mounted in the center of dashboard area.

Modified-V hard-chine hull is shown at left. It is designed to slice through waves, cut pounding. Longitudinal strakes are for lift. Hard chine line gives stability and speed.

maneuverability. While I provided ballast (which he declared to be more than ample), young Jim put the Charger through all the tricky maneuvers he could think up. He found fault with a couple of items —such as torque, which caused difficult steering. But he looked happy all the while he was trying to scare me to death.

"I liked most everything except this tough steering," he reported later. "You really had to work at it to pull it out of a turn. But Dad assures me a trim-tab adjustment would cure that. Pickup was great, and I would say this boat would handle a whole covey of skiers. And at full throttle the Charger really put out."

I endorsed his report. That made it a two-generation vote of confidence in a good big-water boat.

Back from Catalina, we took a careful look at new Chargers under construction in Glasspar's Santa Ana plant. They have a hard-chine hull with a modified-V bow designed to slice through the waves and to soften the ride in rough water. The V entry has been combined with a hard chine at the point where bottom and sides of the hull meet. PS

COMMODORE CHARGER SPECS

Length Overall	Beam	Gunwale Length	Molded Depth	Transom Width
20'2"	94"	22'6"	50½"	88"

Approx. Wt. (w/o motor)	Construction
1,600 lb.	Fiberglass

Accommodations:
Seating for six, including two bucket-type sunbather seats, two single seats aft

Standard Equipment:
Steering, mechanical; windshield, safety glass; deluxe side panels; storage in seawell; twin 18-gal. gas tanks; dual bottom with flotation compartment; ski-tow rings and bow eye; bilge pump and blower; battery, 12-volt; instrumentation includes tachometer; running lights

Price: From $4,495 with 120-hp. stern drive to $5,592 with 225 hp.

Manufacturer: The Glasspar Co., Santa Ana, Calif.

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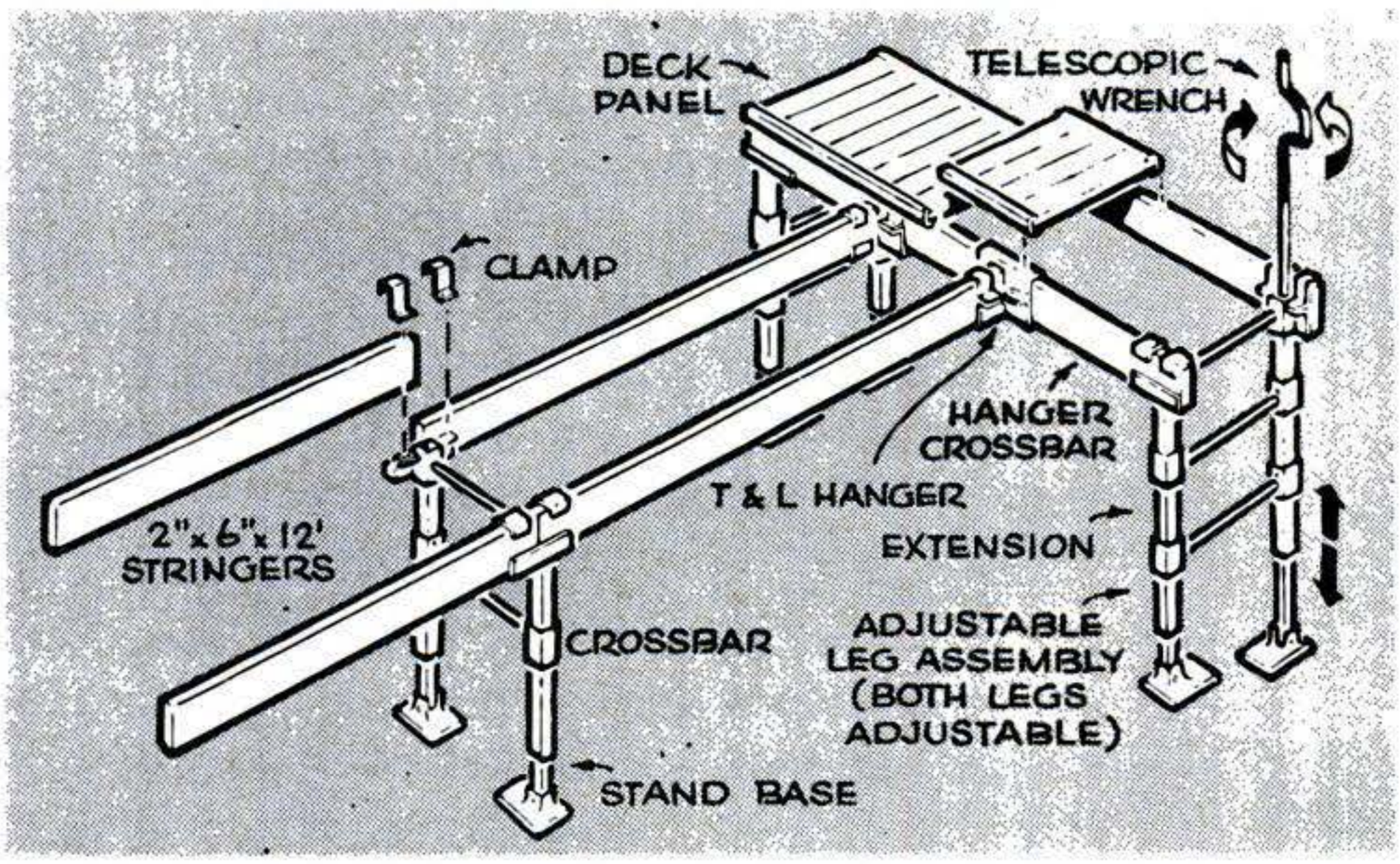
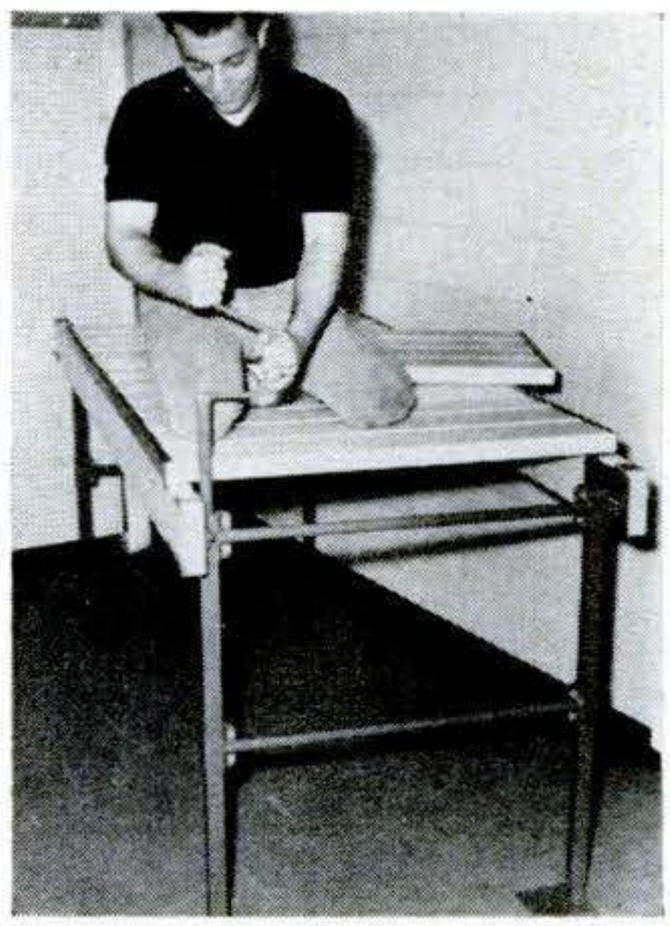
Lightweight kayaks come ready-made or in precut and predrilled kits

Stylish kayaks are now available in five models, from nine to 14 feet and from 18 to 65 pounds. Offered are single-, double-, and three-place models, and a Kiddyak for youngsters. There's a modified three-place job for use with an outboard. All models have a full plywood bottom. Factory-assembled, the kayaks cost $78 to $189; kits, $35 to $84. For a catalogue, send 25 cents to Vicraft Co., Portage, Mich. 49081.

New soft-riding sports cruiser

The Donzi "7 Meter" cruiser (right) has walk-around gunwales, two eight-foot bunks, and a marine head. For power, you have a choice of inboard/outboards or V-drive inboards. Prices, with a single engine, start at $7,295. Donzi Marine, N. Miami Beach, Fla., markets the boat.





Here's an adjustable steel-pier kit that can be installed quickly and cheaply

By using an adjust-from-the-top design, this pier can be installed by one person without putting a foot in the water. Demonstration above, at right, shows how pier is leveled, by means of special wrench (supplied). Each leg contains a self-locking screw assembly with a 12-inch elevation range. Parts are steel, treated for rust resistance. T-pier kit shown, 27 feet long with 12-foot end section, costs $128.35, less lumber. Standard Marine Mfg. Inc., 2116 E. Norse Ave., Cudahy, Wis. 53110.

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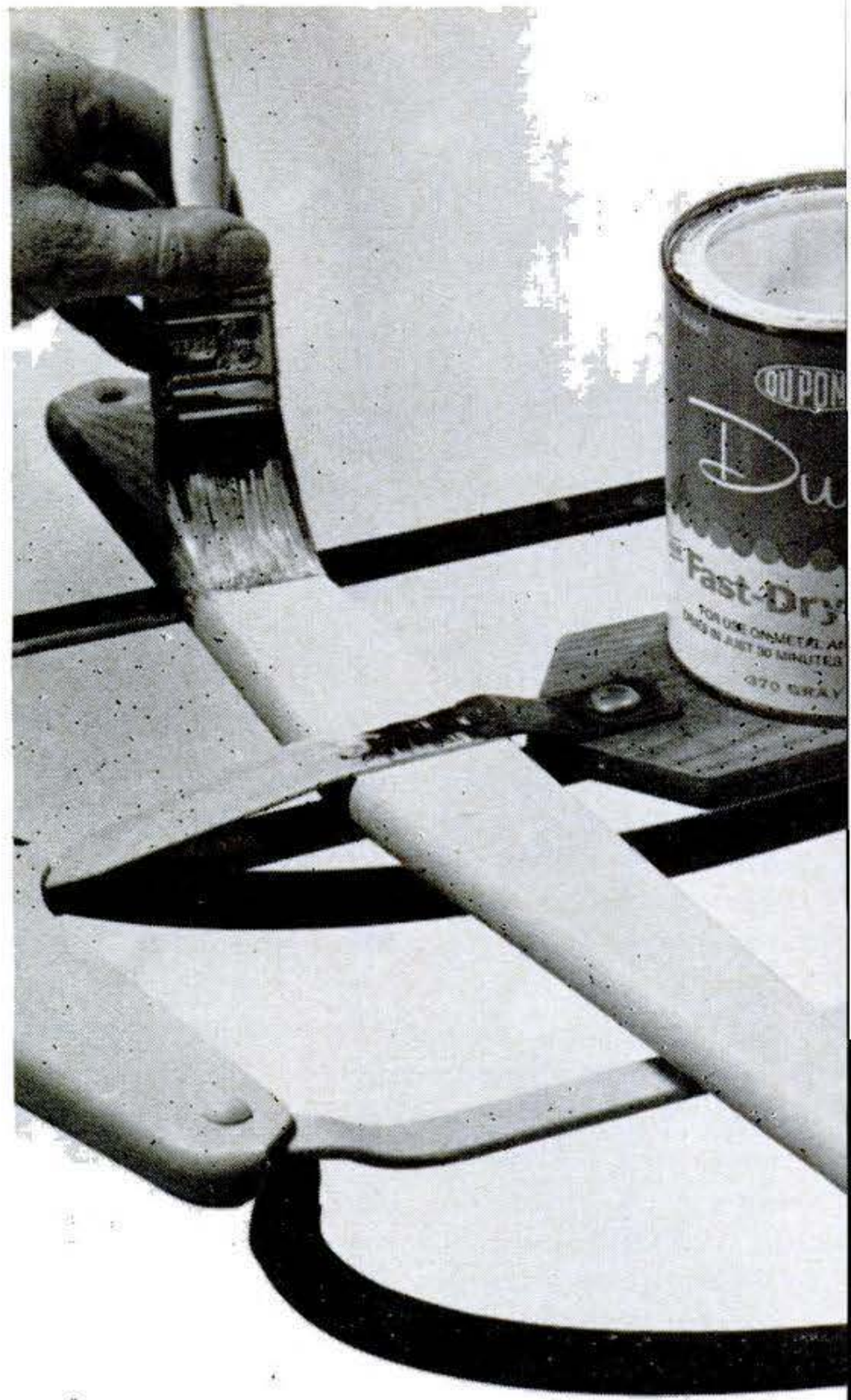
BREAKTHROUGH! New Foolproof Water Paints You Can Use Anywhere

By JACKSON HAND



A latex primer for both wood and metal, that dries in half an hour, is the hot news in paint development. There's no need for two separate primers.

If you've been putting off some painting that really ought to be done, you're lucky. Now you can do it with acrylic latex water-based paint—the easiest painting there is. Inside or outside, siding, walls, trim, metal, even bare iron or steel, latex paints are ready when you are. And so are latex enamels.

Enamels? A latex material on iron and steel? On trim?

Right. Four years ago in PS, I said that the paint industry would have all-latex painting by 1970. They beat the prediction by three years. When you go shopping for paint today, here are examples of what you'll find:

- Semigloss or satin enamels so tough that you can use them in the kitchen, bathroom, or laundry, where sober-minded manufacturers told you a year ago only oil-based enamels would work. And on trim, any place—even on the window sills.
- Improved latex house paints that go right over bare wood with no primer and no additive—and no peeling. Just paint 'em on, unless the siding happens to be a pigment-bleeding wood, which might lend its color to a light-hued house paint. (Cedar, redwood, mahogany, and fir plywood often contain water-soluble pigments, which water-thinnable paints tend to soften, so that they bleed into the colors of the paint; very dark colors mask this bleeding, but light colors are likely to be altered by it.)
- A latex house primer that kills the bleeding tendency of the woods mentioned, and provides adhesion of topcoats equal to the best alkyd primers of the past. Until now, the best paint job called for an alkyd primer for its superb adhesion, then a good house paint. But—that

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New acrylic latex enamels can now be used in bathrooms and kitchens—areas where no latex material has ever stayed put before. Provided the wall itself is dry, you can paint right up to a dripping shower head.

oil-based primer calls for 72 hours of drying time, which means your weekend is shot. Latex primers are ready in two hours; you can get two coats on a lot of your house in one day.

• Most revolutionary of all is a primer for all metals (except copper) in an acrylic latex formula. It is dry in half an hour and ready for top coating, making one-day metal finishing available to the home owner for the first time. Du Pont, last spring, was first on the market with Duco Fast-Dry Primer, but Rohm and Haas reports the same results from one of its formulas available to paint manufacturers, so it's likely the latex metal primer will be in all lines soon. (One of its lateral advantages is that it can be used on wood as well as metal, making a one-primer job out of finishing outdoor furniture of metal and wood combined.)

Breakthrough in latex enamel. Acrylic latex enamels in semigloss and satin finishes are certain to be the biggest boon to the home painter; they solve so many problems. The switch-over from latex wall paints to oil-based enamel for trim has been a nuisance—most of us have been impatient with the need for using oil paints in the bathroom and kitchen.

Most of us, too, tried the early latex enamels which turned the impatience into irritation. The enamels were impossible to apply smoothly. They peeled off like the skin on a banana. They showed lap marks. You couldn't wash them because too much water produced peeling and too much scrubbing washed off the enamel. Several manufacturers tried new formulations, called them back off dealers' shelves, tried again. Finally the

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dealers balked and there was a cease fire.

It was Rohm and Haas who finally turned the trick with a formulation based on the acrylic latex they call Rhoplex AC22. Their prototype formulation, followed by 70-odd paint manufacturers across the country, licks most of the early problems.

Leveling. Early attempts at a latex enamel produced an impossible situation: brush marks that would not level before the enamel started to set. You can accept a little brush-mark texture in a flat paint, but not in a semigloss or satin. The new latex enamels flow out under the brush, forming a smooth surface. I won't say that in the hands of any old amateur painter a latex enamel levels as smoothly as an alkyd, but with careful work, the difference isn't critical.

Coverage. Few of us had the skill and the guts to do one-coat coverage with former latex enamels. The new formula is deliberately "draggy." It doesn't spread as easily—therefore there is less tendency to spread it too far. This gives you coverage—and tends to help with brush marks, too.

Lap marks. "Open time" is greater with the new latex. This means the edge stays wet longer, so you can blend into it with the next brushload without showing the lap. It took a nimble professional to do this with previous attempts at latex enamels.

Repaint. As Rohm and Haas points out, the vast majority of enamel is bought to be applied over previous enamel, a rather obvious fact that seems to have escaped the attention of many paint formulators. What makes the new latex enamels so appropriate for bathroom and kitchen use is their extra-good adhesion when used over standard enamels. Early sorties into the enamel area by latex-minded people produced a product that came off an alkyd undercoating in rubbery sheets. It had no "wet adhesion," as paint people say when they mean it won't stick if it is wet or in a wet atmosphere. This ruined the whole deal for kitchens and bathrooms, of course.

To accomplish these miracles in latex paint qualities, they have had to tamper with a few other miracles.

Quick-dry. Most formulations based on Rohm and Haas's acrylic Rhoplex AC22 contain ingredients specifically intended to slow down drying. Typically, the enamel takes on its normal sheen in about half an hour or a bit longer, but it is not yet hard and may even continue to level brush marks. At this point, the enamel is entirely dustfree and dry to the touch, but it is not ready for recoating for several hours. (Specifications vary for recoat; check labels.)

Sag and run. Increasing the open time and improving the leveling qualities of latex enamel required sacrifices in viscosity, or what might be called thixotropicity. This means there is a greater tendency to sag on vertical surfaces. Sagging, of course, is never a problem if a latex enamel is applied properly, but sometimes when a color change is great, an attempt to do it all with one coat can result in overloading the vertical surface, causing sags.

A byproduct of increased open time, however, is more open time for clean-up, too. You can be a little more leisurely about wiping up spills and spatters. Brushes still wash easily in soap and water even after they have stood for a while. Most important, the brush is easier to wash all the way up the bristles to the ferrule, where latex paints usually dry and make cleaning difficult.

A clear topcoating, too. If you want much the same semigloss or satin finish over an existing flat latex paint, it's obtainable with a clear topcoating. You first apply a flat wall paint to all surfaces—such as walls and trim—to establish the color. Then, to gain extra durability, you brush the clear latex over trim, on doors, and other places where extra wear calls for a surface easier to clean than flat paint. An example of this covering material is Sapolin's Clear Latex Coating.

When you start brushing. There are a few tricks to using latex enamel:

- Be sure to use a primer on bare wood —Du Pont's Fast Dry, or other latex primers as they become available.
- On repaint work, check the old paint for adhesion. If it is not sound, scrape it off or use remover, and feather-sand any edges. Wash the old surface with a strong detergent or trisodium phosphate or—best of all—a product such as Wil-Bond

[Continued on page 180]

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This five-year-old is at home on the supercompact. If a kid can ride a tricycle, he (or she) can master the Little Petro in a few minutes. There's no brake. Open the throttle, you go; close it, you stop.

Vehicle will support a 250-pound man—and do right smartly, even up a grade. Big gear reduction and high r.p.m. supply amazing amount of torque. Two wide footrests act as stabilizers. Even a clumsy rider has a hard time falling off. Wheels are on roller bearings, tires solid rubber. Tank holds a pint.

Tiny Power Bike Really Goes

In El Monte, Calif., a man named Jim Odom has produced a motor bike with these specifications:

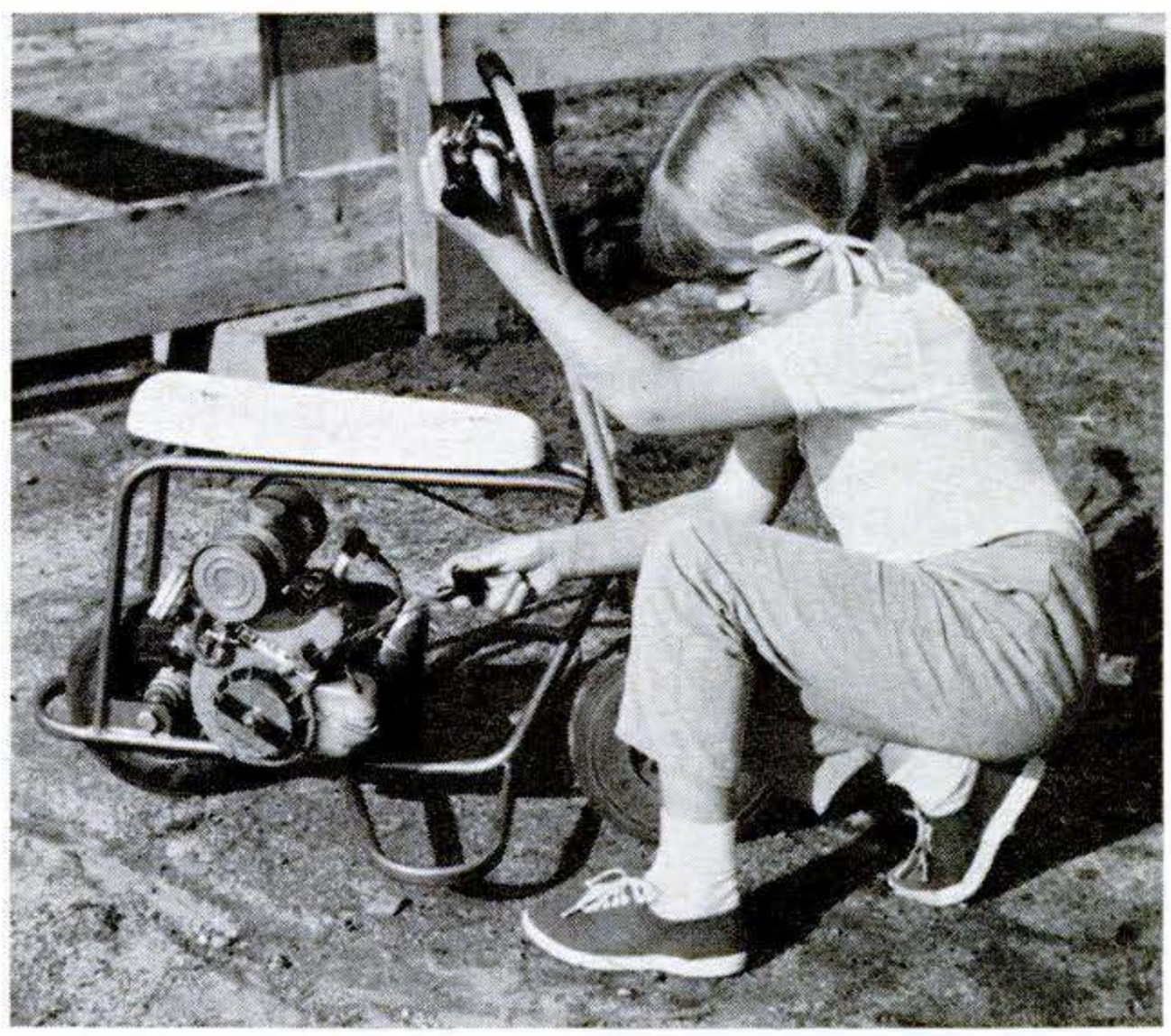
Length, 29 inches; height, 26 inches; weight, 27 pounds; engine displacement, 1.31 cubic inches; horsepower, one (that's right—one); top speed, six m.p.h.

It's a sort of supercompact.

Odom innocently produced a prototype, and suddenly he was in business. Neighbors wanted copies. Cycle shops began ordering it on sight. So many orders poured in that he had to set up a production line.

And, oh, yes, the Little Petro, as Odom calls it, is just for kids.

Grownups ride it, though. It can be geared for a whopping 10 m.p.h. on request to The Odom Mfg. Co., 10437 S. Rush St., El Monte, Calif. 91733.



A pull on a cord starts the engine. It sports a clutch and gearbox, a chromed muffler with curved tailpipe, a fuel-sediment bowl, and a shutoff valve. The fuel-oil mix is 30:1. Frame is ⅝-inch steel tubing. A tank of fuel runs engine from 45 minutes to over an hour, depending on whether Junior or Dad is riding. About $100, not counting delivery.

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Build Your Own REENTRY

Space-vehicle design gives you an exciting sports kite

By WILL YOLEN

A kite in the space program? Yes, and POPULAR SCIENCE has made it possible for you to build your own. At this very moment, space scientists are running tests with the kite shown here. It may help solve the reentry-from-space problem for astronauts, enabling them to set down on land instead of splashing down at sea.

This is unlike any kite you have ever seen; there's no framework and it's floppy. The kite, invented by NASA engineer Francis Rogallo, is so different that he had no trouble obtaining several patents on it. Head of the Low Speed Vehicle Branch, Rogallo experimented in the NASA wind tunnels.

Ordinary kites were used to test air turbulence. But stick-frame ones shattered easily, and too frequently, when turbulence slammed them against the wind-tunnel sides. Tiring of constant repair jobs, the inventor substituted shroud lines for the sticks. Tests proved his idea worked; the kite could take a beating

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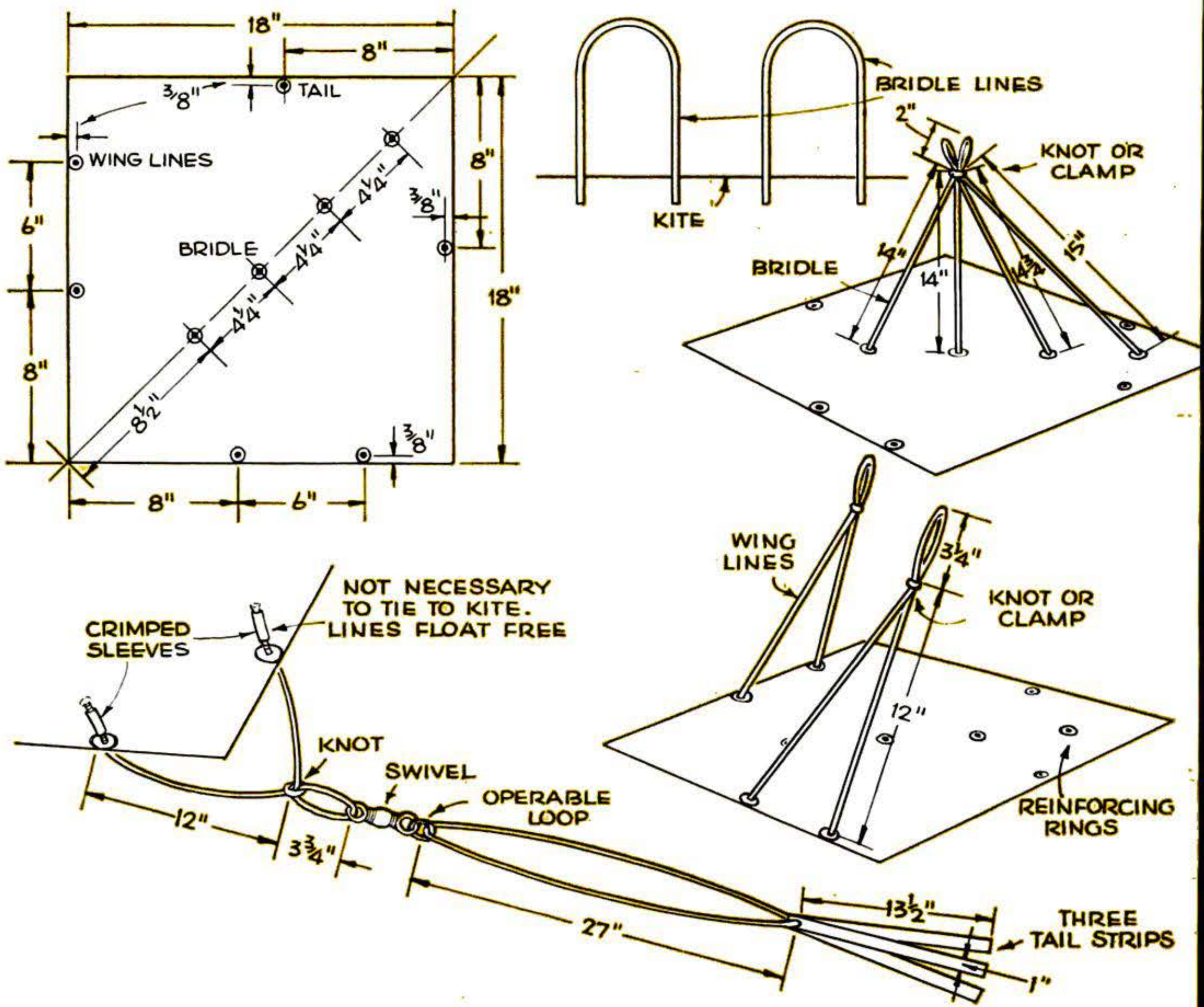

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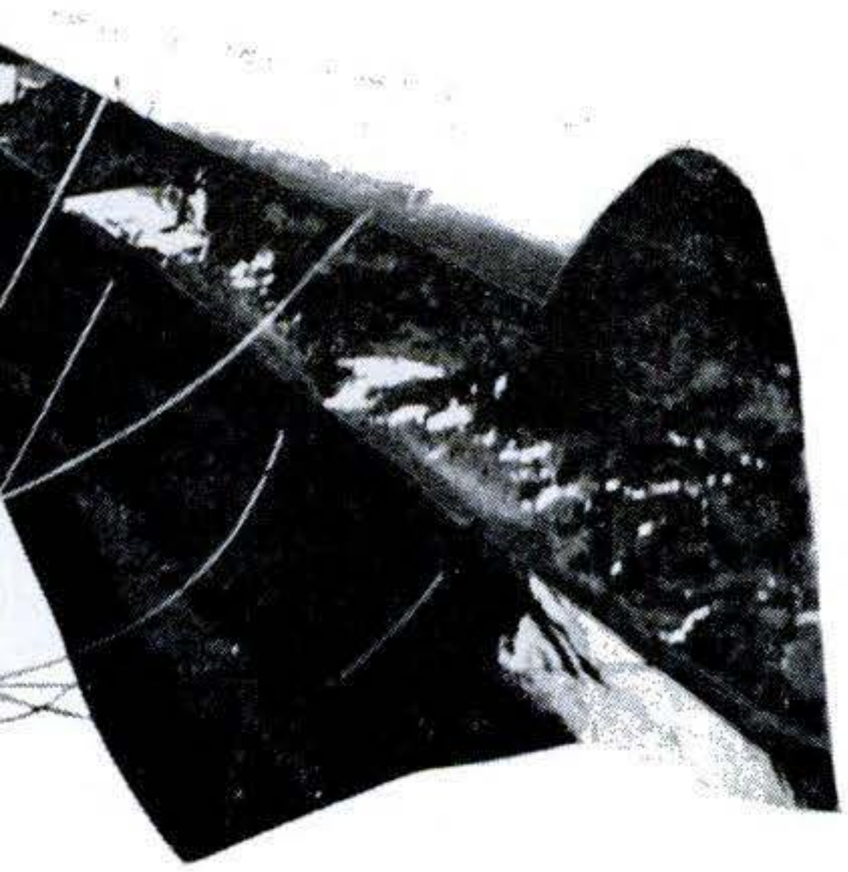
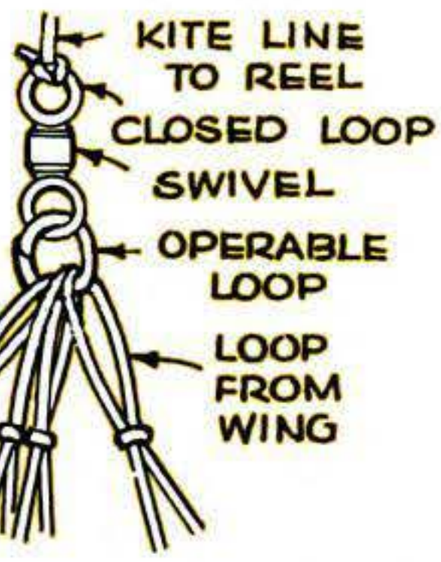
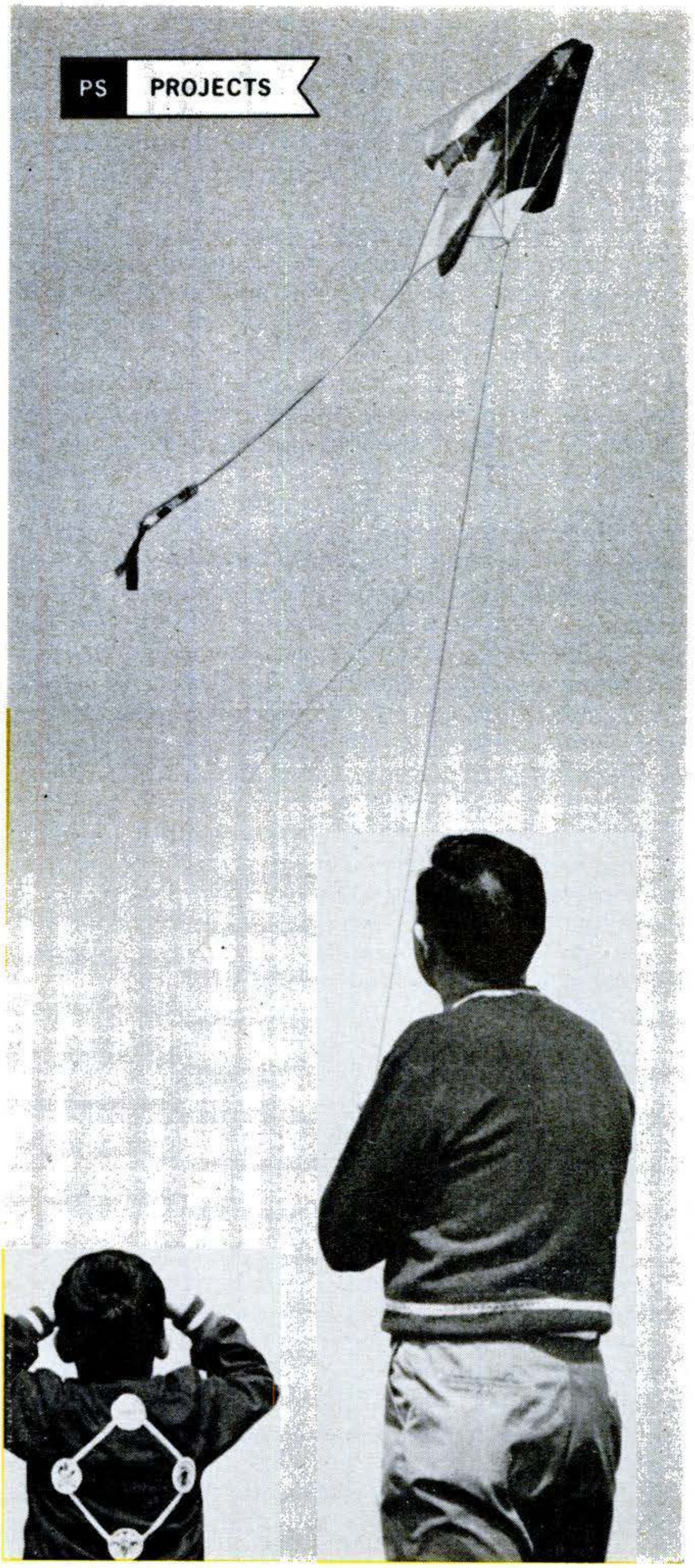
KITE





Aluminum-coated Mylar (see top photo) proved to be the best material. The brown wrapping paper (photo above) formed lift-reducing creases.



Rogallo kite soars into blue after launching. Once filled with air it's almost impossible to keep it down. With a little practice you'll master dives, climbs, and loops. Use a fishing rod and reel for best line control.

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and come out without a bit of damage.

Because it bends to turbulence and there are no rigid members on the kite, it can go through the sound barrier without breaking up. The thermal barrier is no problem as no friction is generated as it glides through the air.

These facts interested the government. Research-and-development contracts were awarded to Ryan Aircraft and North American Aviation. The contracts call for extensive exploration in areas other than space, too. The kite is being tested for Army cargo-drop use, and there's hope it can be used as a powered man-carrying craft.

It looks like a kissin' cousin to the parachute, but there's a difference. A parachute develops drag and descends; the Rogallo kite uses the static air current on the underside to give lift. Now the inventor has given his permission to POPULAR SCIENCE readers to build their own. But this approval is for personal use only; you can't make them for sale.

Choosing a material. Construction is simple; just make certain your measurements are accurate. There's a wide choice of materials. We tried brown wrapping paper, aluminum-coated Mylar, and polyethylene. The first two materials flew well; polyethylene wouldn't fly at all until the wing edges and axis were made more rigid by adding tape to them. The brown paper flew easily but, after eight or 10 flights, in strong beach breezes, it formed wing creases and lift was reduced. The Mylar was best in every way.

Start construction by cutting the kite to the dimensions shown in the drawing. Fold the paper to form a triangle and run the fold between the thumb and index finger to make a crease. The side of the paper with the valley is the top when finished. Measure and mark for the holes. Don't make the holes any larger than you need to get the lines through. It's best to reinforce the holes with notebook rings or Scotch tape.

Cut four pieces of line 36″ long for the shroud lines. Assemble the bridle first. Lay the kite down with bottom up. Pass the four ends from two lines through the holes on the crease. Hold the two loops together and tie a knot 2″ back from the ends. Make sure the string is flat and straight. Measure back the right distance for each line and mark at that point on the string. You'll find the right point quickly when you turn the kite over. Do the same to make the wing lines; note the different loop length. Turn the kite over and slip a crimping sleeve on each strand, position at the mark, and crimp with pliers. Knots will do the job too, as long as they're large enough. Trim off the excess line. If you're using nylon seine, heat each cut to prevent unraveling. The four loops are attached to the swivel, as shown in the sketch.

For the tail, cut a 40″ piece of line and insert it in the closed ring of the swivel. Line up the string ends, centering the swivel, and tie the loop knot. Attach this section of the tail to the kite, using the same method as for the shroud lines. The tail strips are made of the same material as the kite. Pass a 54″ length of line through the holes and tie the ends together. Attach this loop to the swivel.

Aluminum-coated Mylar is usually available at hobby and notion counters. Clear can be found in artist's-supplies shops. Get the crimping sleeves at a fishing-tackle store; the small ones work fine. Kite size can be altered, but hole spacing and shroud lines must be adjusted in proportion.

Where to fly it. The beach, because there is usually a breeze there, is an excellent place to fly this kite. If a beach is not handy, use an open field free of power lines and trees, and away from buildings. Pick a day when the winds are parallel to the ground; they're better than the puffy, gusty variety. If you have a fishing rod and reel, use it to fly the kite. It gives you better control when putting the craft through its paces. To get it aloft, you can either cast it in the air, or jerk it into the air from the ground. Stand with the kite in front of you and the wind at your back. Let the line out in short bursts.

There's no need to run with this one. In fact, it's a job to keep the kite down. If it dives, slacken the line. The kite will refill with air and right itself. To put it into a climb, pull on the line, reeling in rapidly. With a little practice you'll invent tricks of your own. To bring the kite in, walk to it, reeling the line in. Store it flat to keep it from wrinkling.

The countdown is on—happy flying. PS

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Here's the latest in Popular Science's new series on getting to know your car. If you're one of the many car owners who admit they don't have a very clear idea of what goes on under the hood—but would like to learn—these articles will not only save you money on upkeep but will add a lot to your enjoyment of your automobile.—The Editors

ABCs of Keeping Your Car in Tune

THIRD OF A SERIES:

At 60 m.p.h. your sparks must be timed to a thousandth of a second. Here's how you can check ignition timing to save gas, gain power

How to Time Your Sparks

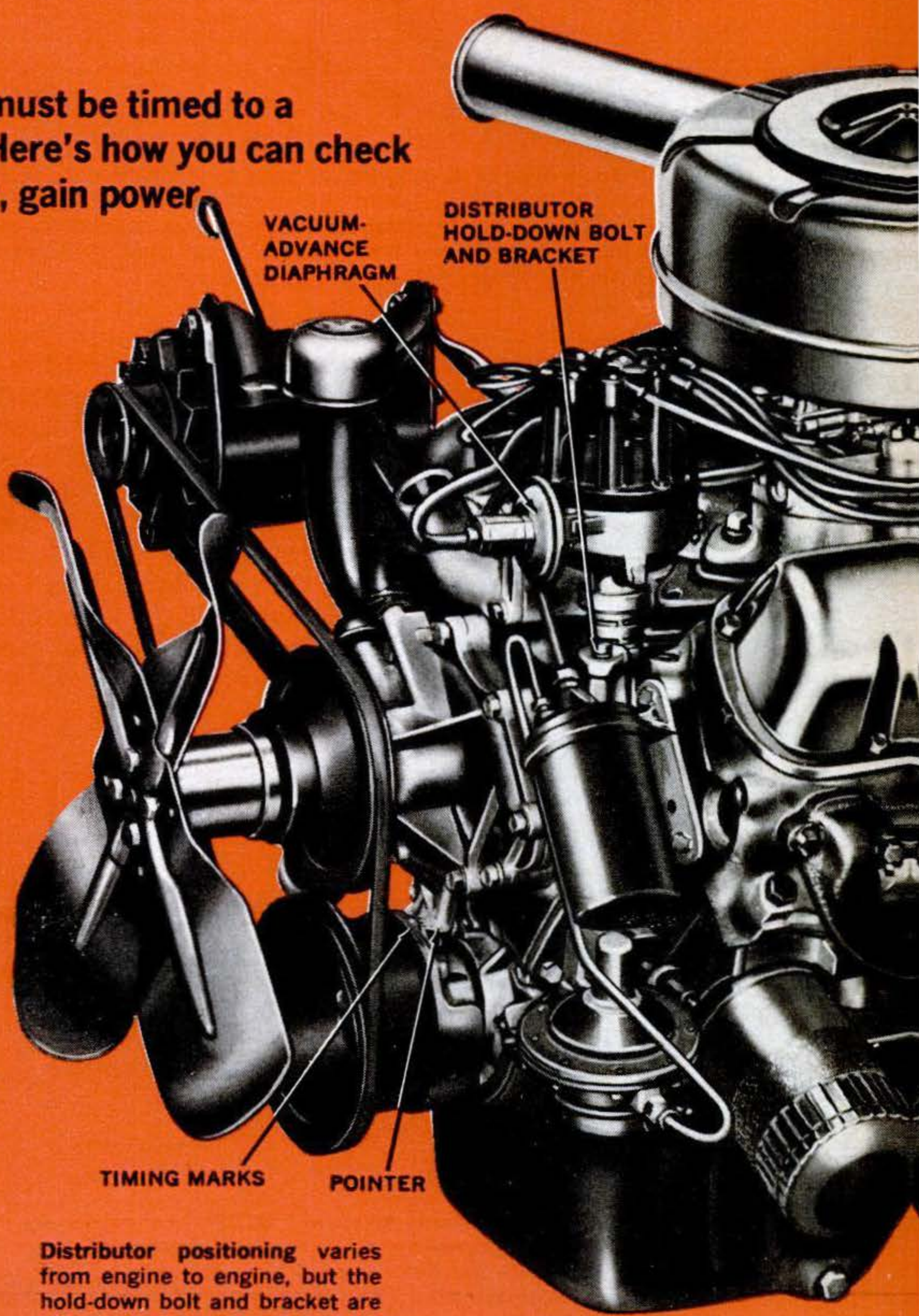
By HERB CARRIER

I have told you earlier in this series about the plugs that fire your engine and about the contact points that trigger the spark. Now I'll tell you about timing the spark.

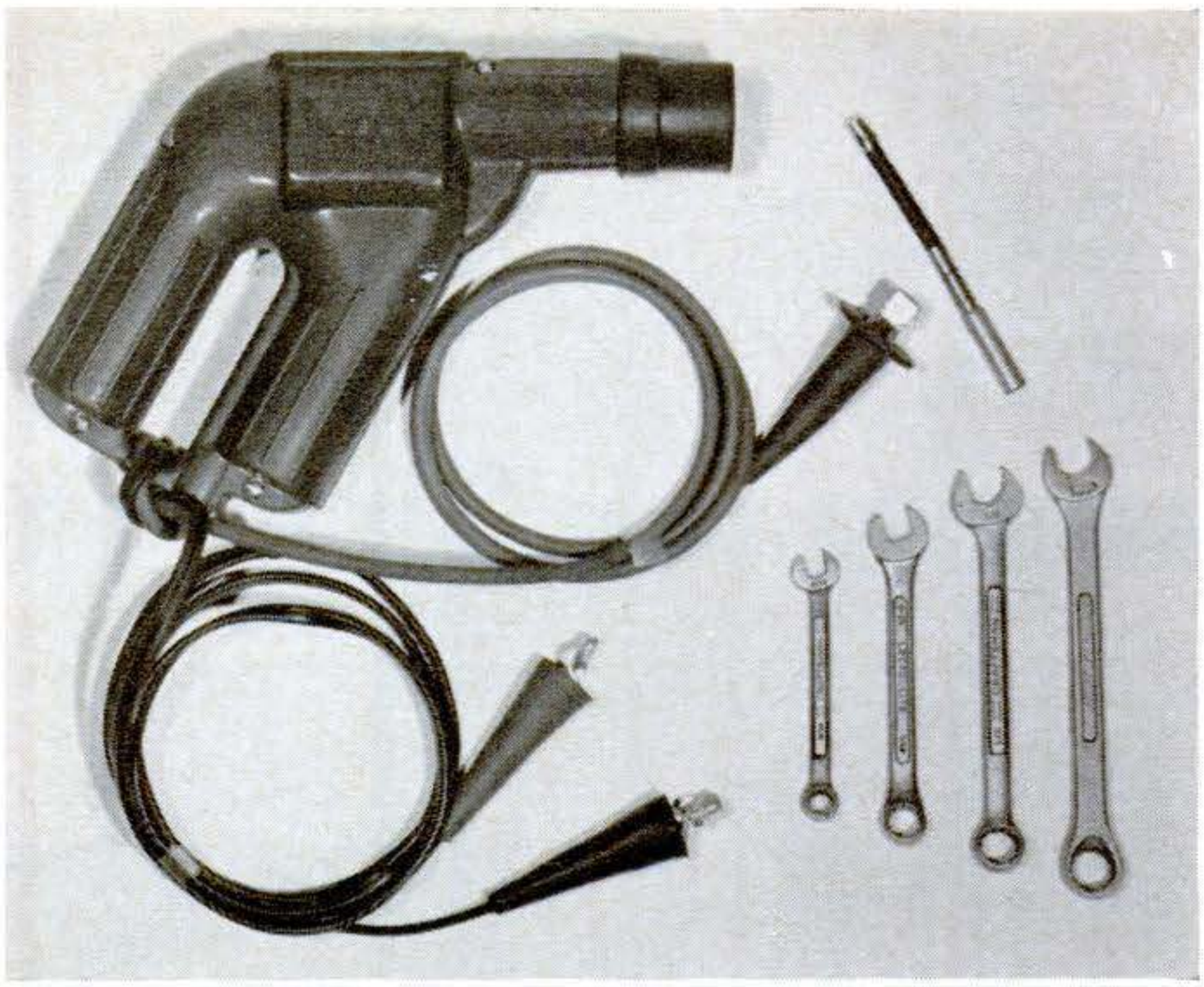
How important is ignition timing? Well, a delay of 1/1,000 second at 3,000 r.p.m. means a spark retard of 18 degrees. That's enough to throw your engine completely out of tune.

The precise instant when the spark should occur varies with engine speed and load. Proper timing at idle is a lot

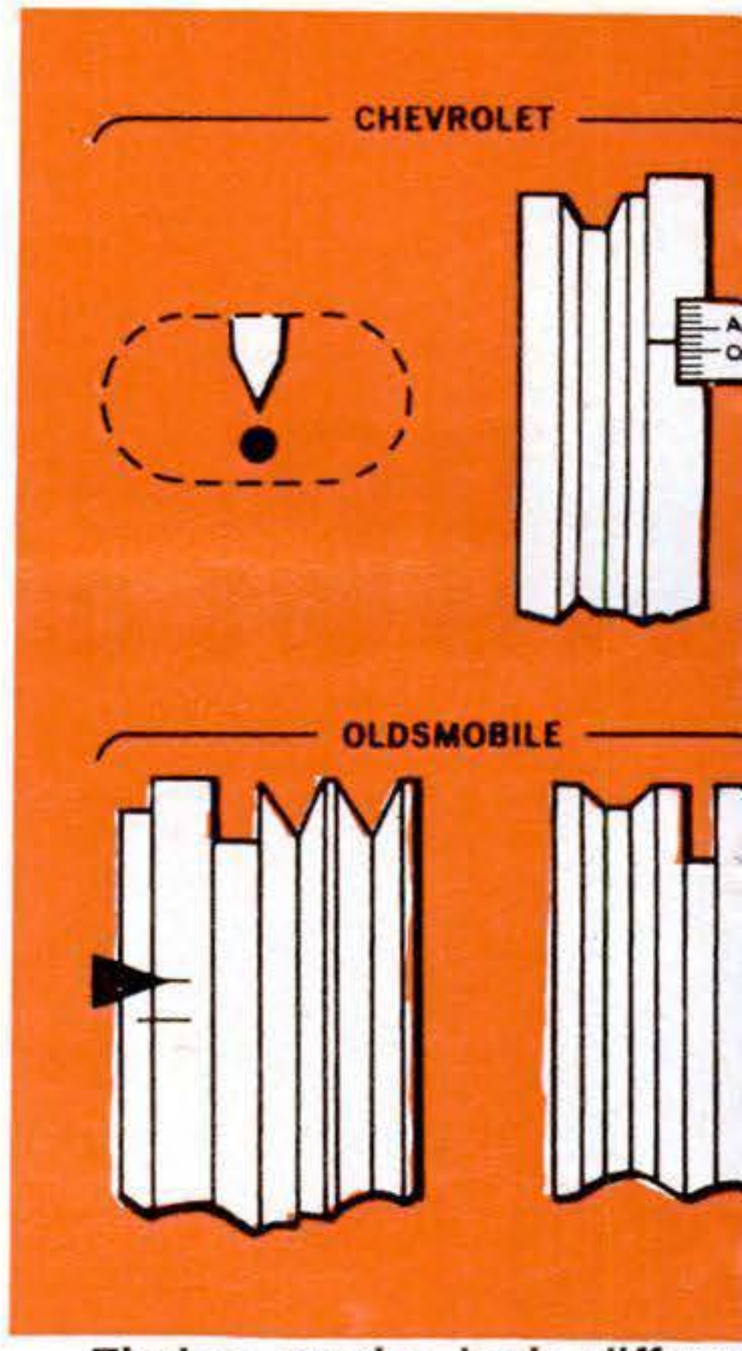
Continued



Distributor positioning varies from engine to engine, but the hold-down bolt and bracket are always close to the distributor shaft, below the body.



The tools you'll need to do a timing job are a timing light and adapter, plus a wrench that fits the distributor hold-down bolt. Always use an adapter (shown near terminal of the fat wire) as connection point between the timing light and the Number 1 spark plug. Connect the thin wires to the battery (red wire to positive post).

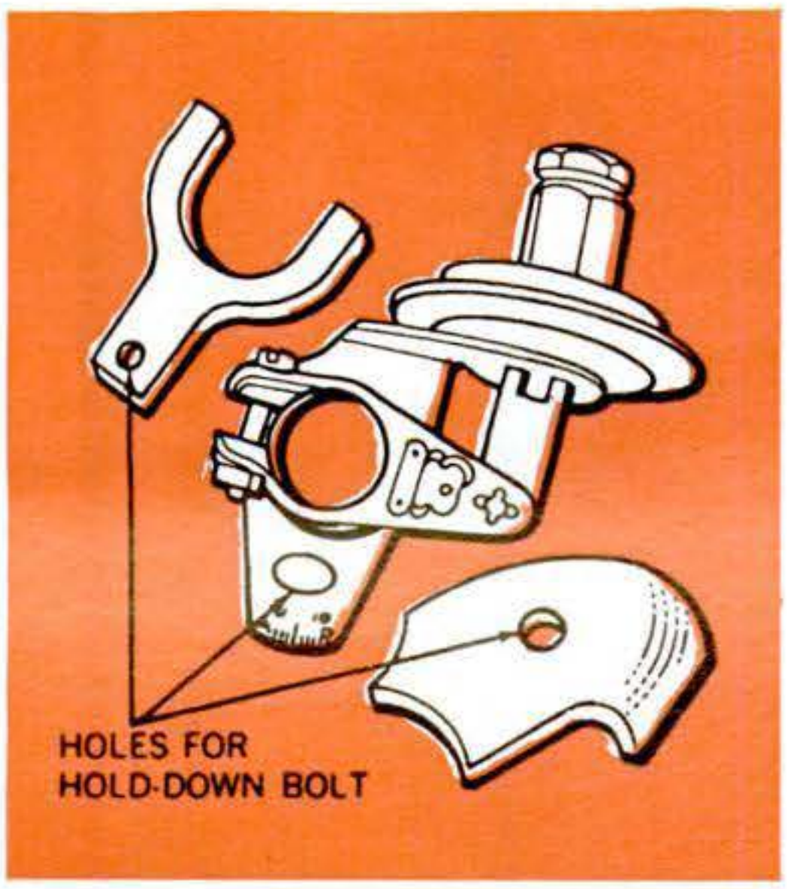


Timing marks look differe

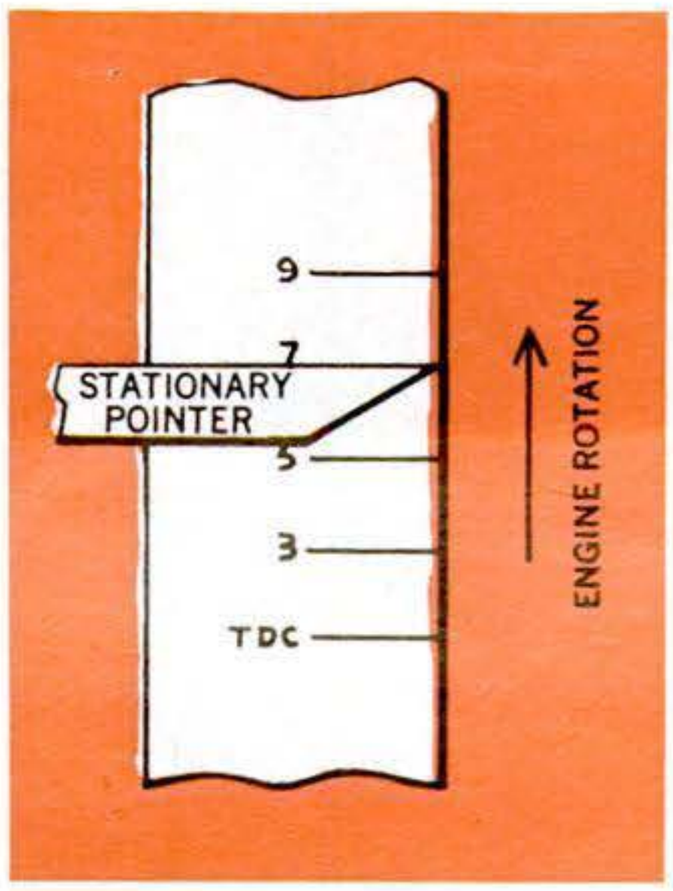
different from proper timing at high speed or when climbing a steep hill with the accelerator clear to the floor and the engine working like mad to keep up a road speed of 30 m.p.h.

Let's use an example: You have your rifle and you are plinking away at a stationary target. Naturally, you aim smack at the bull's-eye. With the same rifle, shooting at a target that's moving rapidly across your sights, you *lead* the target so that the bullet and the target get to some predetermined point at the identical instant.

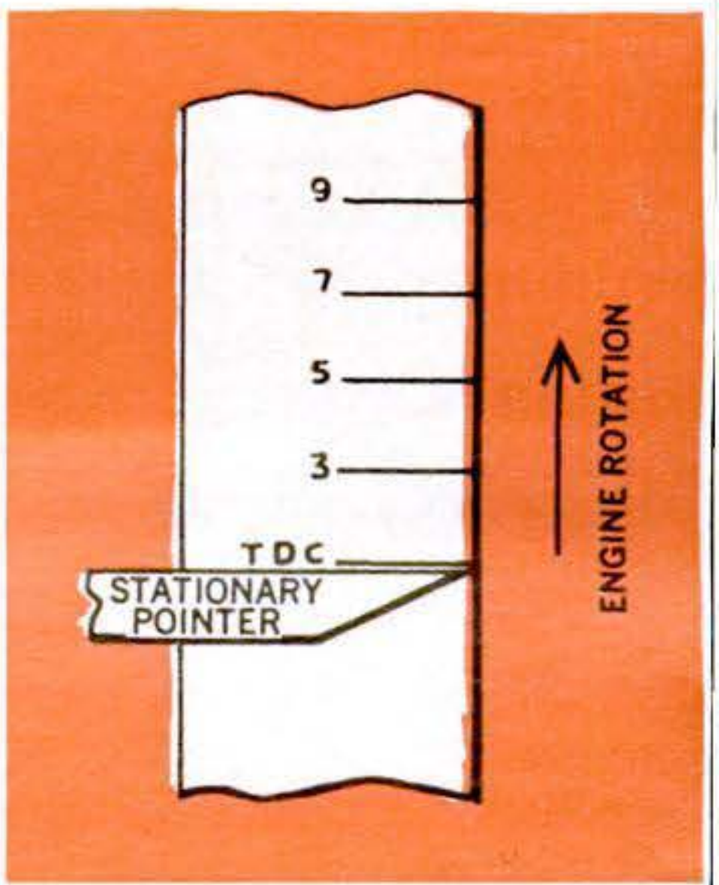
It's the same way with the engine in your car. At idle speed (stationary target) the spark occurs pretty much at TDC (top dead center, or the moment when the piston is at the highest point before it starts downward). At higher engine speeds, the spark must occur considerably before TDC for the combustion



Distributor hold-down clamps differ in size and shape. Here are three current examples. Note the fine calibrations on the elaborate clamp. This is an octane selector to accurately match timing with fuel quality.



BTDC: The marks are in this position when plug fires seven degrees before TDC (top dead center). Stationary pointer is fixed to engine; timing marks turn with crankshaft pulley.



TDC: The marks are in this position if plug fires at top dead center. The position of the timing marks relative to the pointer is changed by turning the distributor body.

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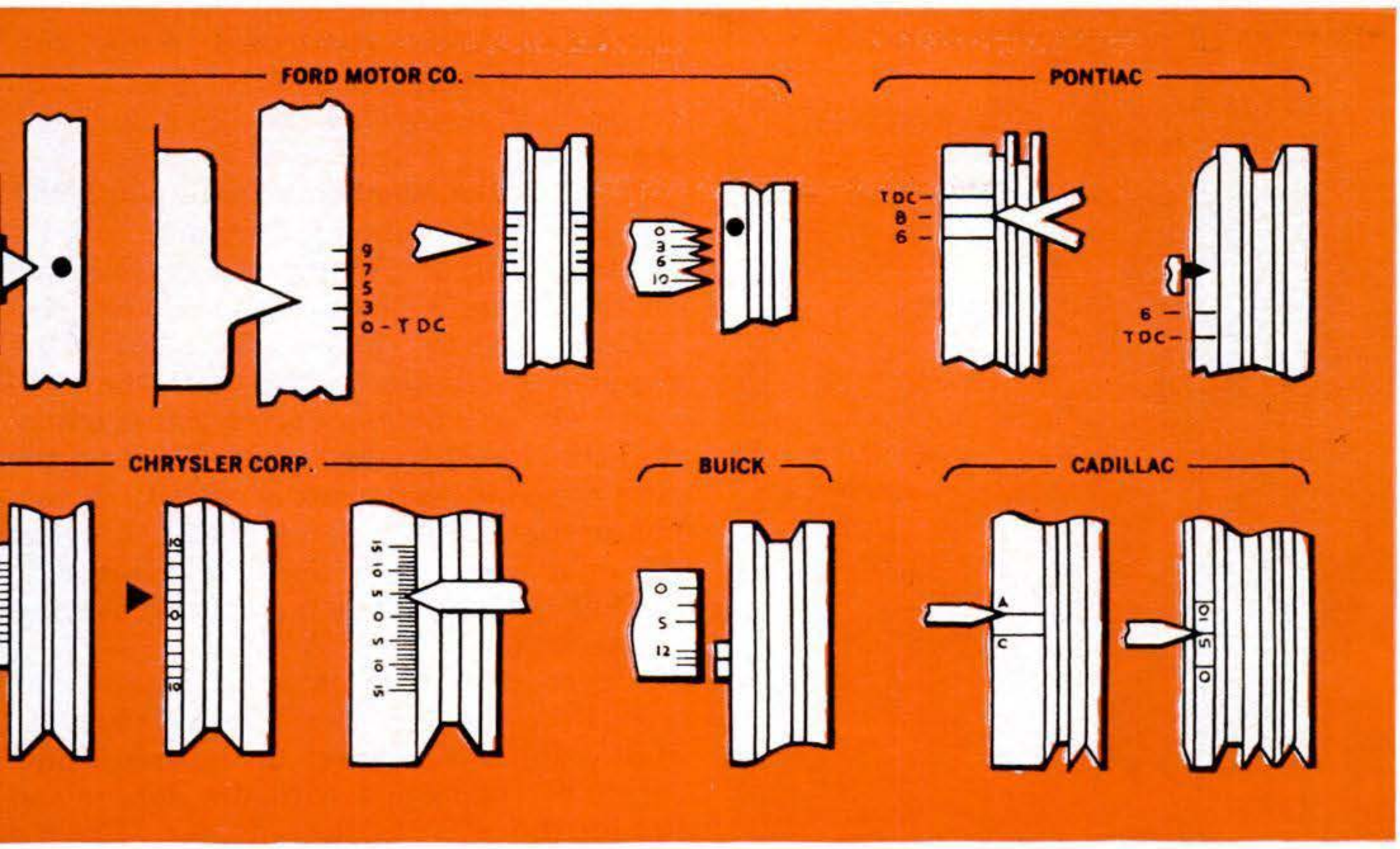

rent engines. Most engines have nose marks, though flywheel marks are still found.

to keep up with the rapidly moving piston. It's a matter of timing the combustion so that it produces its maximum force when the piston is in a position to accept it. Again, like shooting at a moving target.

Two types of ignition timing. Keeping these points in mind, it's easy to see why all automobile ignition systems have two kinds of ignition timing: initial ignition timing and automatic ignition advance.

Correct initial timing is simply a matter of positioning the distributor body so that the basic spark will occur when it should occur, usually four to 10 degrees BTDC (before top dead center).

Initial timing is changed by turning the distributor body. Most distributor bodies are held to the engine block with a single bolt and bracket. The bracket either clamps to the distributor body or fits around it like a horseshoe. To turn the distributor body, it is only necessary to loosen the hold-down bolt, rotate the distributor body (clockwise or counterclockwise as required), and retighten the bolt securely.

Automatic ignition advance is obtained by varying the position of the distributor breaker plate relative to the distributor body so that the spark occurs earlier and earlier on the compression stroke as the engine runs faster and faster. The automatic ignition advance either works or it doesn't; there are no adjustments, but there is a simple check and a correction, as I'll explain in detail. You can check both initial timing and automatic advance without the aid of a lot of special tools and technical training.

Your first step should be to get the shop manual for your car. The next thing you'll need is a timing light. A quality light that will do the job, even in bright sunlight, will cost you about $18 to $20, but it will last you for years and save you many times its cost. Like all good tools, however, a timing light cannot be abused or mishandled.

Beware of friends who say that they can "power-time" your engine without the aid of a timing light. They are speaking of advancing your timing until the engine gives out with a *plink, plink, plink* sound when it is accelerated under heavy load, such as with a wide-open throttle in high gear at low road speed. The plinking sound is actually pre-ignition, which can seriously damage your engine. Power timing can burn holes right through your pistons.

A timing light is really a simple device. A good light has three electrical wires

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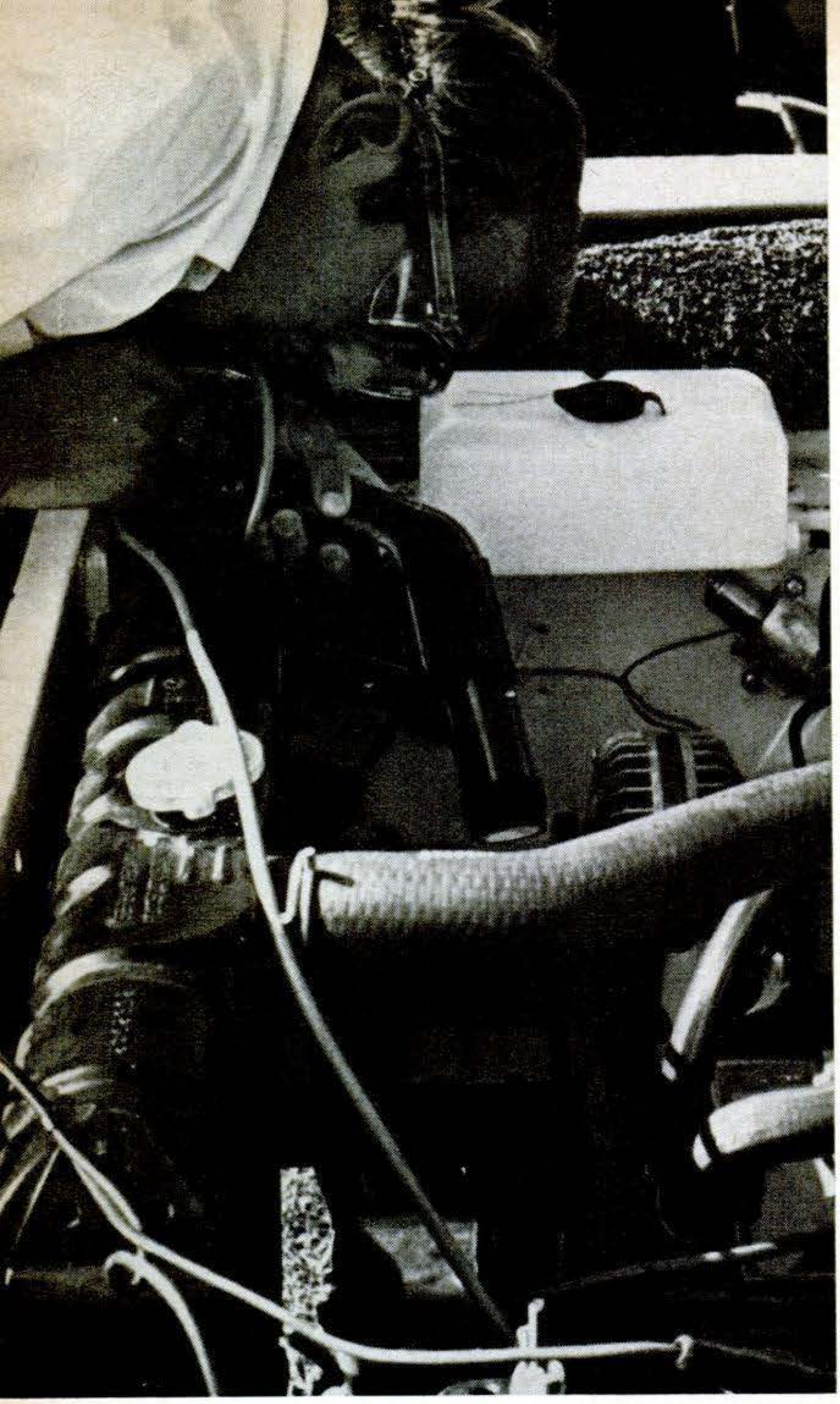
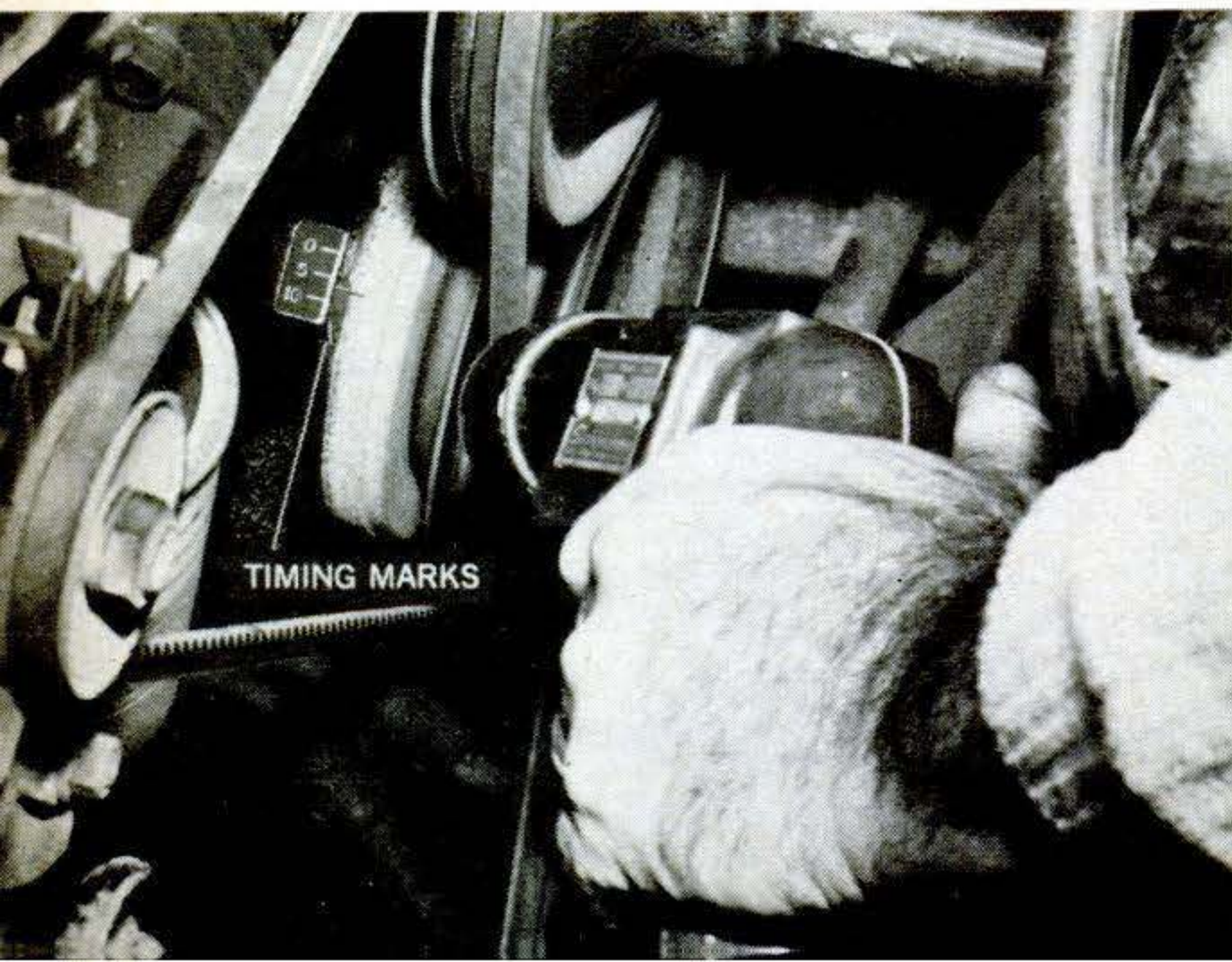


Ignition timing can be checked in bright sunlight if a quality timing light is used. Aim the light at the timing marks. Goggles are a good safety feature.

Engine fan and belts can be a danger to timing light and hands. Some mechanics loosen the belts to keep the fan from turning while timing the engine.



(leads), two slender and one fat. The slender leads are connected to the battery (red lead to the positive post). The fat lead is connected to the Number 1 spark plug.

Which is the Number 1 spark plug? It's the plug in Number 1 cylinder. All ignition timing on American cars is based on the engine's Number 1 cylinder. On in-line engines (fours and sixes), the Number 1 cylinder is closest to the radiator. On V engines (sixes and eights) it's still closest to the radiator, but on the side opposite the steering wheel. A mechanic determines the Number 1 cylinder on a V engine as the first cylinder on his left-hand side when standing in front of the engine and facing it.

To connect the fat lead, remove the wire from the Number 1 spark plug, install a suitable adapter to the spark-plug terminal (furnished with the light), and attach the wire to the adapter. Do not poke sharp instruments, such as an ice-pick or a paper clip, into the Number 1 spark-plug wire to serve as a connection point for the timing-light lead. You'll damage the wire if you try.

After you install the timing light, remove the metal tubing from the pancake-shaped can on the side of the distributor. This can is the vacuum-advance diaphragm, which we will talk more about when we discuss automatic ignition advance. For the time being, disconnect the tube fitting (3/8- or 7/16-inch open-end wrench), remove the tube from the can, and cover the open end of the tube with masking tape to prevent possible "vacuum leak" into the engine during the timing checks.

With the engine running at normal idle (about 500 r.p.m.), the parking brake set, and transmission in neutral, you're all set to check initial timing.

Timing marks. Most modern engines incorporate a metal pointer (about one inch long) and scribed or cast timing marks as a means of checking ignition timing. The pointer is usually located at the very front of the engine directly behind and below the fan. The timing marks are usually on the crankshaft pulley.

To check initial ignition timing, simply aim the timing light so that its flash (occurring each time the Number 1 spark

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plug fires) illuminates the pointer and the marks. Even though the engine is running at about 500 r.p.m., the marks and the flywheel or fan pulley will appear to be stationary. If the pointer and the marks line up as recommended, the initial ignition timing is okay and no adjustment is required.

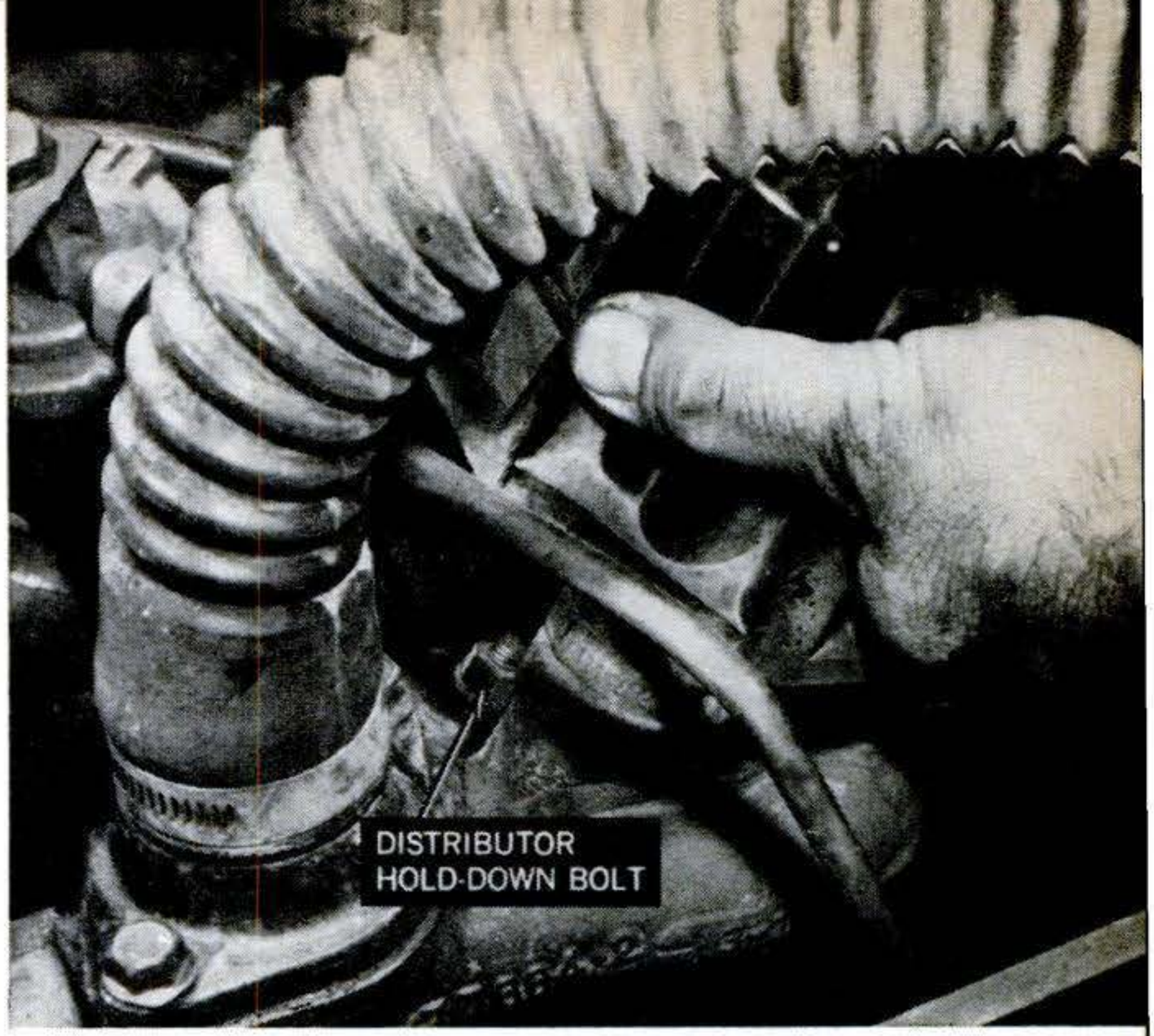
If the timing marks do not line up as recommended, loosen the distributor hold-down bolt and rotate the complete distributor-body assembly clockwise or counterclockwise until the marks do line up. Then tighten the bolt and recheck the timing marks.

Distributor breaker-point gap adjustment [PS, June] affects ignition timing. Every thousandths of an inch the point gap is too close will retard timing one degree and vice versa; therefore, point-gap adjustment must be correct during timing checks.

Checking ignition automatic advance. Remove the masking tape and install the metal tube and fitting, tightened properly, to the vacuum-advance diaphragm. With the timing light aimed as before, accelerate the engine in quick, short bursts while watching the timing marks. If the automatic-advance mechanism is working properly, the timing should advance quickly with each burst in acceleration. After acceleration, the marks should return to their original position. Some engines provide up to 30 degrees' ignition advance and their timing marks are calibrated accordingly.

If the timing marks fail to snap forward with each burst in engine speed, slowly raise engine speed to about 2,000 r.p.m. while watching the timing marks. If the timing still does not advance with engine speed, stop the engine and check the advance mechanism of the distributor. Remove the distributor cap. It's often helpful to remove the rotor also to get a better view of the breaker plate.

The best check for a vacuum-advance diaphragm, like it or not, is to remove the end of the metal tubing opposite the diaphragm assembly. Wipe the tubing reasonably clean, place it in your mouth, and draw in to create a vacuum. When you do this, the distributor plate should move towards the diaphragm (about ½ inch total travel). The plate should hold in the advance position as long as the vacuum is held, and it should return to its original position when the vacuum is relieved. No movement of the plate under vacuum means a ruptured diaphragm. Slow return of the plate while the vacuum is held means a leaking diaphragm.



With the distributor hold-down bolt loosened (but not removed), the distributor body can be turned to obtain correct initial ignition timing. The spark is advanced when the distributor is turned in the direction opposite to rotor rotation. Since the rotor in some engines turns clockwise while others revolve counterclockwise, it is smart to watch the timing marks as the distributor body is turned.

In both cases, the vacuum-diaphragm assembly should be replaced. A new one costs about $2.50, and it is installed easily with a small screwdriver and pliers. Before replacing a diaphragm assembly because the plate won't move under vacuum, move the plate manually towards the diaphragm. Sometimes the diaphragm is okay but the plate is fouled up, which means major distributor repairs by a competent mechanic.

If the advance diaphragm is okay and the plate is free to move but you still don't get satisfactory spark advance with engine acceleration, the trouble is probably with the centrifugal-advance mechanism (on distributors so equipped). Any difficulty with the centrifugal-advance mechanism calls for the services of an expert mechanic. Centrifugal-advance mechanisms rarely give trouble. Chances are that any fault with the automatic advance will be cured with vacuum diaphragm replacement. PS

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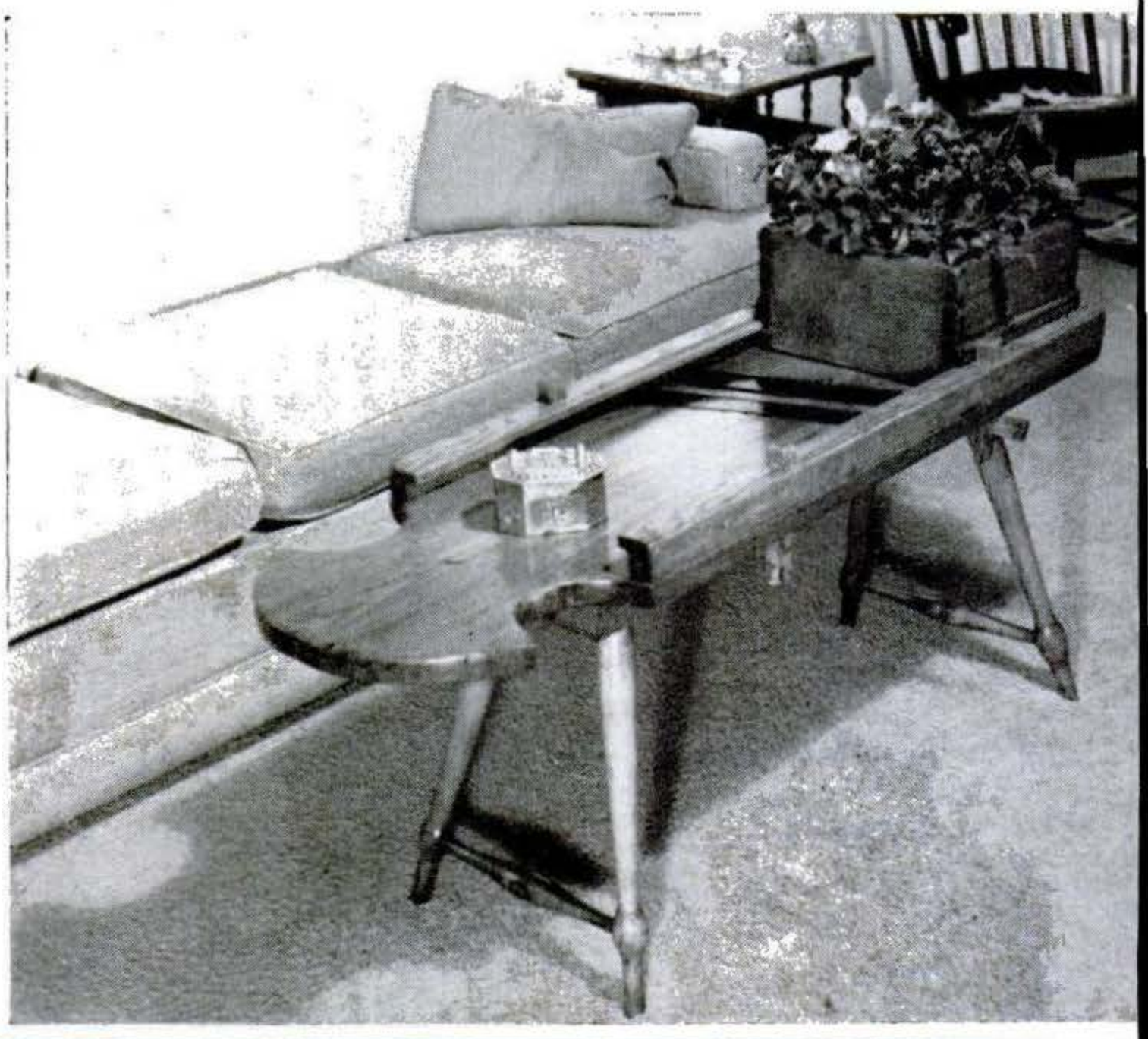
FOR MODERN LIVING:

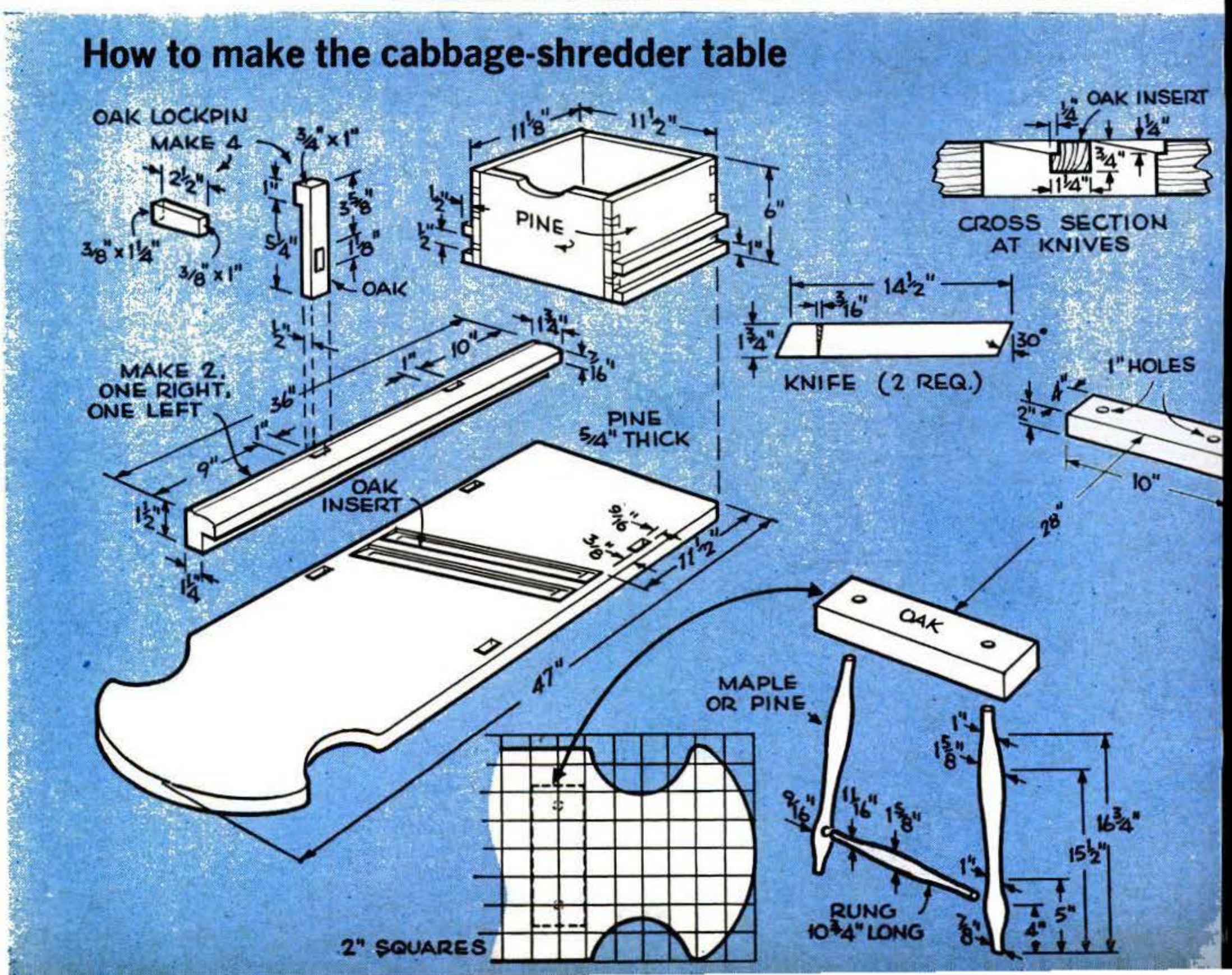
Two Coffee

SLAW-BOARD TABLE

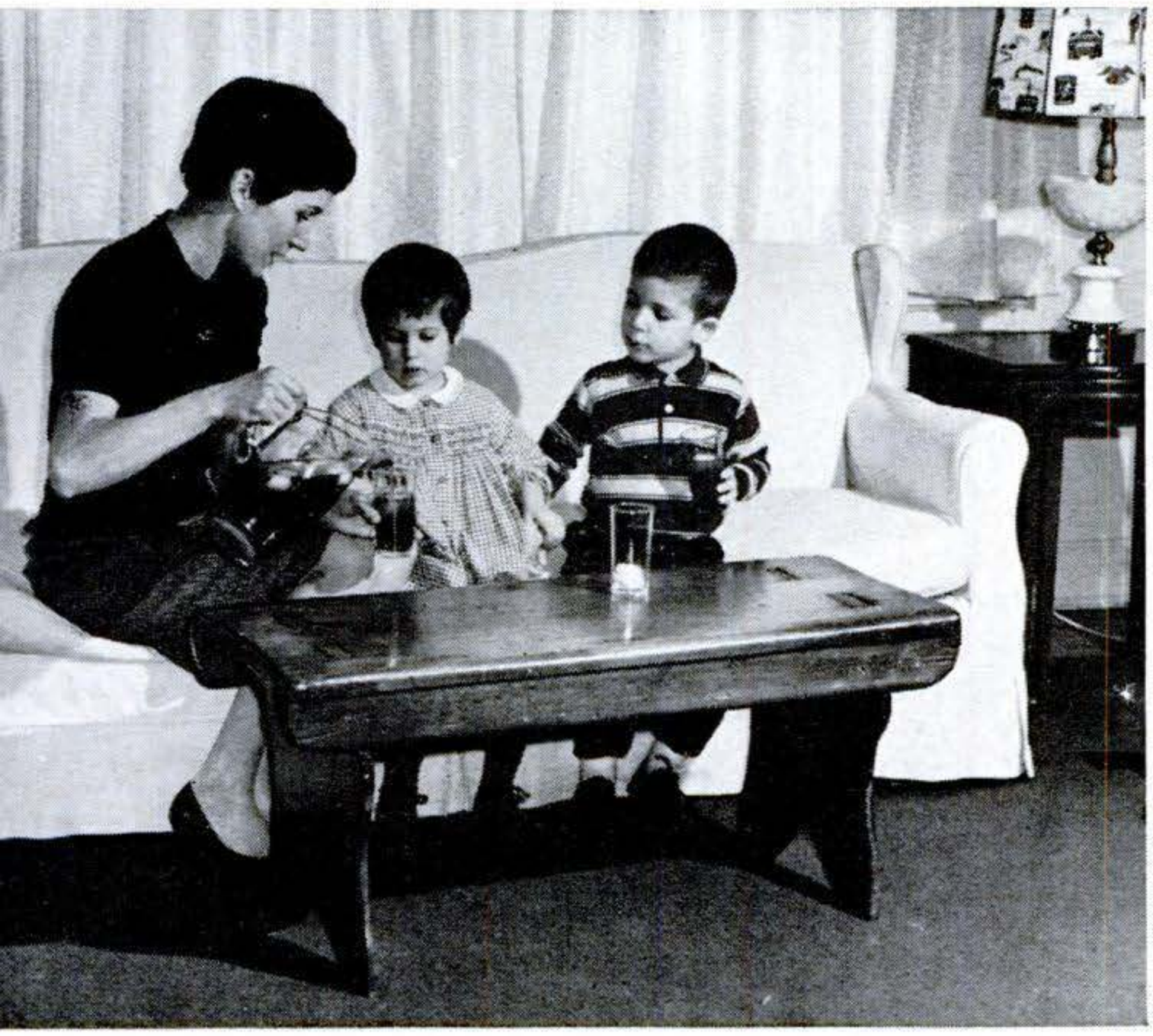
Turn a cabbage shredder into a coffee table by adding turned legs. The charm of an Early American device, plus its useful function as a table, add up to a pleasing project.



How to make the cabbage-shredder table



Tables Out of the Past



SAILMAKER'S BENCH

The double-duty bench at left will serve as a coffee table or seat. Stick to the job and you can build and finish one of these in a weekend.

Continued

JACK PAYNE

POPULAR SCIENCE has dug into the past come up with two attractive projects the home-workshop enthusiast. An l cabbage shredder inspired this coffee ole. In its original use the slaw board ually had no legs; a cabbage was placed the sliding frame and passed back and th over the knives, shredding it into w. A barrel under the knives would ch the vegetable shreds. We eliminated e barrel and added turned legs that e in the period style—and the result is a ndsome table.

The board is made from a solid piece 5/4″ pine. After cutting in the leg tches, round off the end to suit your e. The opening for the knives is made a 30-degree angle across the board to e dimensions shown. Add the ¼″ strip the edge of the cutout for the ends of e blades to rest on. A piece of oak, set as a crosspiece, holds up the back of e front knife. The knives are not fas- ned, but held in place by the rails.

Lay out and cut the rectangular holes for the pegs; when making the two side rails, be sure that the peg holes line up with the holes in the board. The box is made of 5/4″ pine and dovetailed at each corner. If you prefer, corners can be rabbeted. The guides are ¾″ and added to the box. Solid oak is used for the pegs and lockpins; these are fitted individually to each hole. Position and attach the legs as shown—if you use ready-turned legs, you can substitute heavy dowel for the turned spindle. Make the knives of steel. Since you're probably not going to shred cabbage in the living room, for safety's sake, keep them dull.

Choice of finishing technique is up to you. The table shown was treated with a clear finish that brought out the beauty of the oak. Remember, there's no bottom on the box. Make a receptacle out of copper that will fit snugly inside the frame and you have an attractive showcase for plantings—or for storing ice cubes for a short time. Make sure that the joints are well soldered; test for watertightness before you drop the liner into the box.

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By HARRY WICKS

This version of a sailmaker's bench is a variation of those in wide use during the 18th century. In New England, the local craftsmen stitched sails while seated comfortably on benches such as this. The construction details are simpler than you would expect in a bench of this type. For example, note the mortise-and-tenon detail in the photograph. As you read on you will discover that pictures can indeed lie; a clever woodworker can employ tricks and skills that simplify the task, yet do not sacrifice authenticity.

Start the project by cutting the lumber to rough dimension (cut slightly oversize) for the seat, legs, and rails. Seat and rails are 5/4″ pine; all other wood is ¾″ pine. Plane edges that are to be joined to insure that they are square. Glue, dowel, and clamp the pieces that will be the seat and legs. Corrugated nails can be substituted for the dowels. However, on the legs where they will show, set them deep with a nail set so that on the finished product they will give the illusion of being distress marks. While these parts are drying you can go to work cutting and shaping the rails. The two grooves are made in the seat as shown to receive the rails. The cleats are cut from one-by-three stock, grooved and attached to the legs. Mark the bench seat for the four false mortises. Drill starting holes and complete the cutout with a saber or keyhole saw.

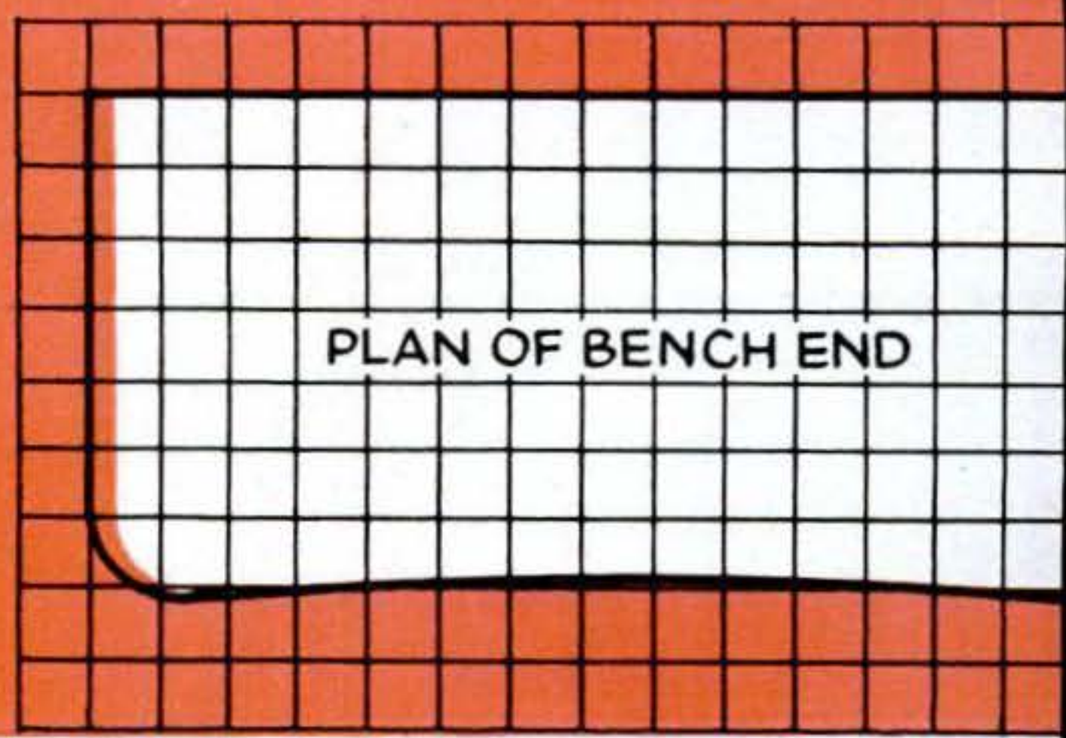
Professional craftsmen sand the parts before assembly. By using this method you will avoid swirls that tend to occur in corners as a result of post-assembly sanding. It will also shorten the time it takes to do the job. After sanding, you're ready to put the bench together.

The rails are fastened with 6d common nails; remaining joinery is accomplished with screws as indicated. Use glue on all joints. When attaching the rails with the 6d nails, set the heads deep and roughen the holes slightly. Glue and insert the false tenons. For the wedges, use any

Mortise and tenon? No, just a clever carpenter's trick. A drawing (upper corner at right) shows you how to achieve this effect—quickly and simply.

shop scrap. A different species of wood—walnut, for example—offers an interesting contrast. In the bench shown, cedar shingles were at hand and proved to be a good choice.

The authentic sailmaker's bench had a hole on the surface that accommodated a mast to which the sails were attached. Eliminate this detail if you intend to use the piece as a sit-down bench. However, if it is to be used as a coffee table the hole will make an excellent receptacle for a planter. If your wife has a favorite vase or jug, the hole can be custom-cut to receive it. The bench in the photo was finished by applying knotty-pine oil stain, followed by two coats of semigloss varnish. After a week of drying it can be waxed and buffed to give the bench the appearance of being hand-rubbed. PS



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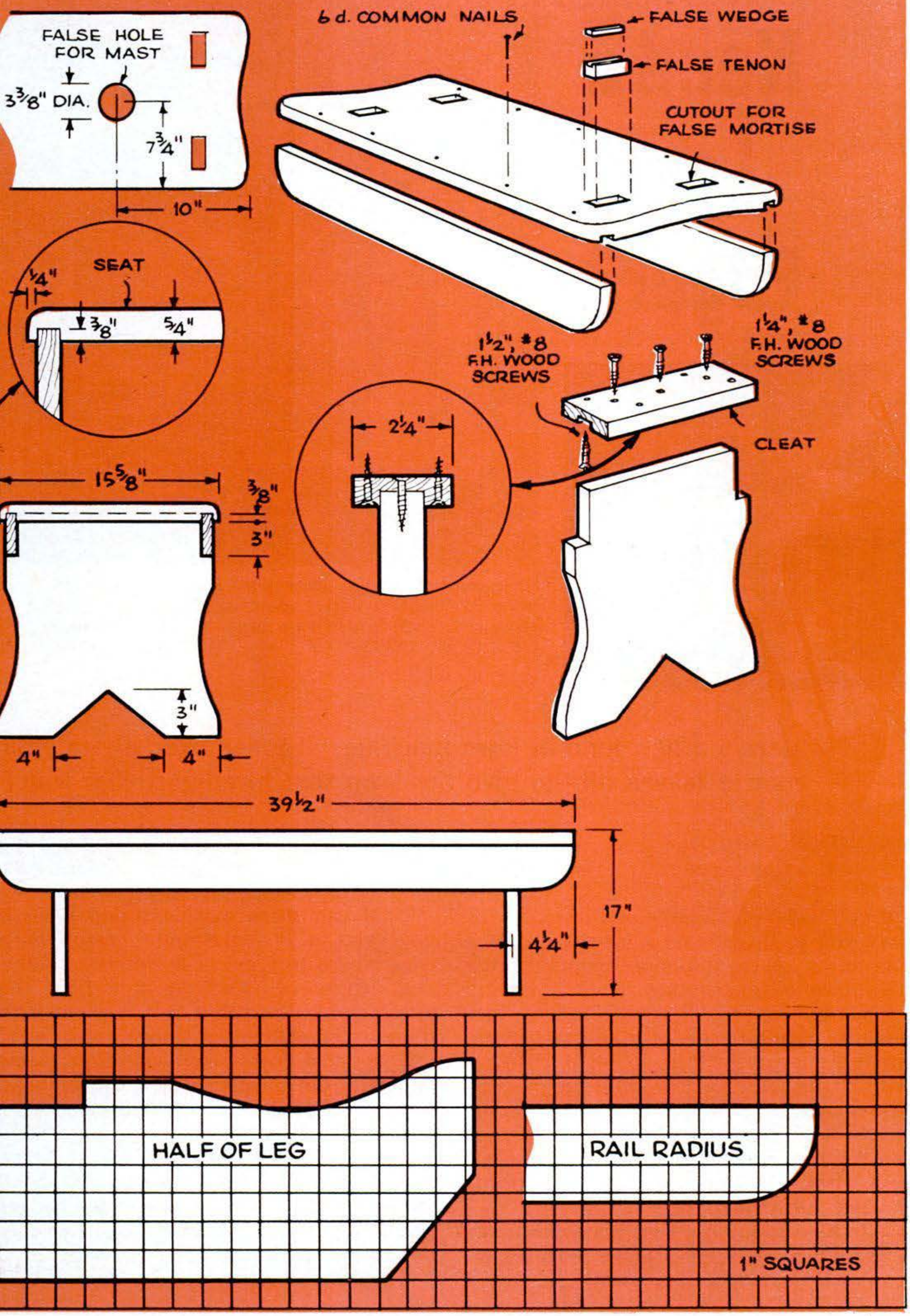
How to make the sailmaker's bench



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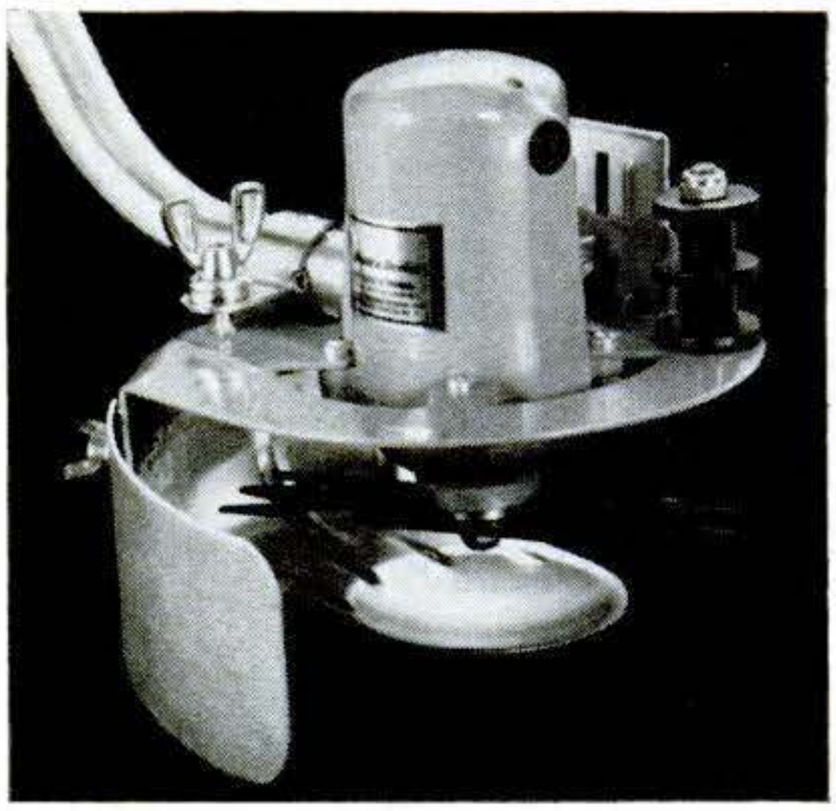
Do You Need a Lawn Edger?



Maneuverability in tight spots is the great talent of edger-trimmers. Black & Decker electrics ($30 model shown above and at left) feature unusually good guards and shoes that prevent bottoming of blade, act as edging shield.

Here's a new kind of lawn machine. It takes over where your mower leaves off—to give the lawn that hired-gardener touch

By ANTHONY WHITTIER

If you insist on a manicured lawn, it will pay you to investigate a lawn tool that's becoming more and more popular. It's the power edger-trimmer.

Not too long ago, a man who lives in a suburb where residents take great pride in their lawns had to go on a business trip. Our man got his wife to promise she'd tootle around the power mower while he was away. When he returned, he could see that his wife had done her job. Still, the lawns on either side of his looked just a bit spiffier.

He soon found out that his neighbor to the right had bought a power edger-trimmer, which had been promptly borrowed by his neighbor to the left. He did some borrowing, too, and was back in the running in the lawn-beauty sweepstakes.

What can these machines do? They'll give you a string-straight, razor-sharp edge where turf meets flowerbeds, walks, and driveways. And do it without the sweat and tedium that always went with the job. They do other things, too.

Some just trim, some just edge, some do both. On most, a tilting cutter head lets you trim the grass to the very edge, around fence posts and lawn ornaments—impossible with mowers. With the blade in the trimming position, you can hook out leaves and debris from under hedges and shrubs. Set a tilting blade at a 45-degree angle and you have a trencher.

They're versatile. They go into nooks

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With the head set at 45 degrees, this Rockwell $40 electric model can also be used as a trencher.

Yazoo edger-trimmer is powered by a three-horse Clinton gas engine. Height control is on the handle.

and corners inaccessible to a mower and are more manageable on steep slopes and in dips and hollows.

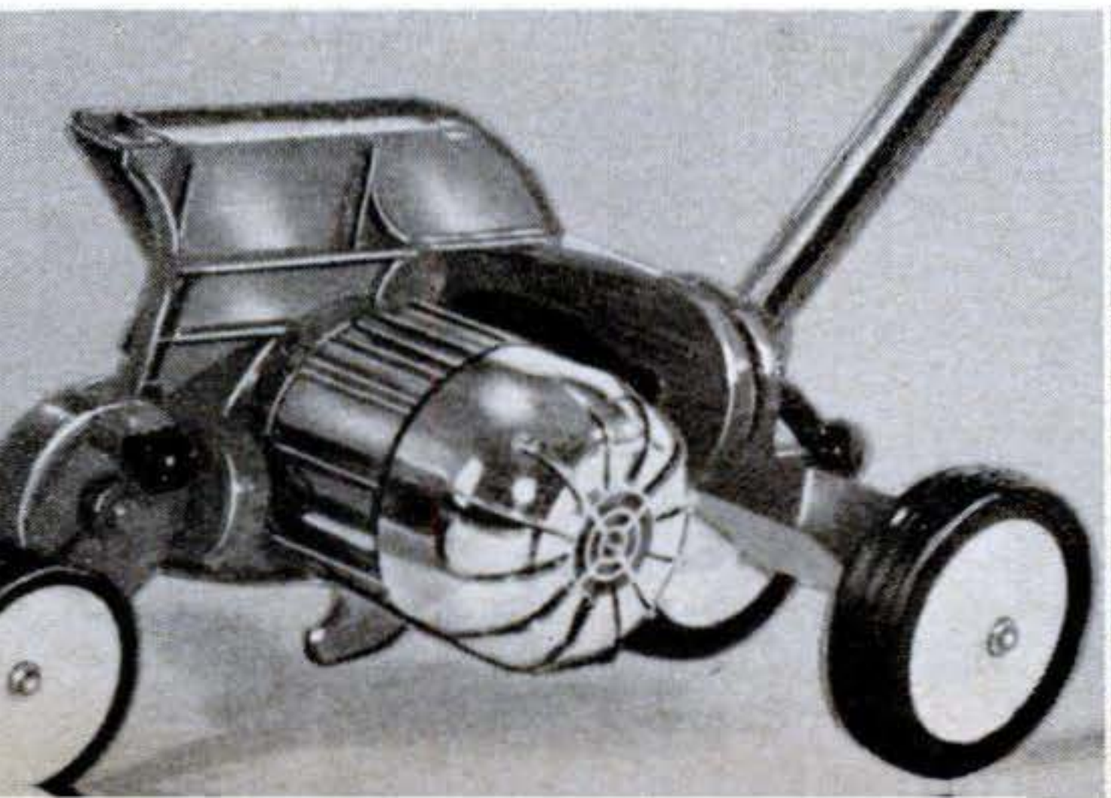
Gas vs. electric. Basically, these tools consist of a small rotating blade mounted on a wheeled chassis. The electrics are lighter in weight and less powerful, and the blade is mounted integrally with the motor. The head tilts, motor and all. Gasoline-powered models are belt-driven. The cutter head tilts independently.

On the gas models, height of trimming and depth of edging is usually controlled

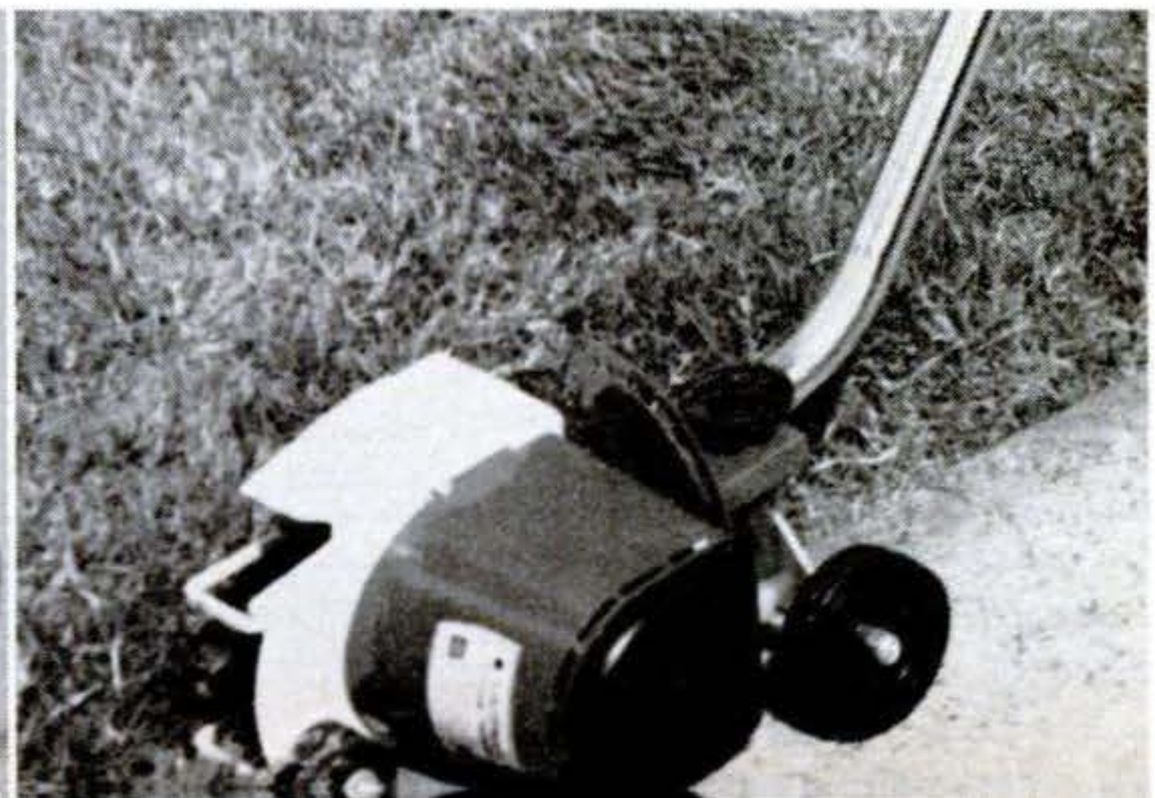
Continued

For variations on a theme, Rockwell's cutter-bar grass shear ($30) doubles as a hedge trimmer.

Sears' electric unit with one-horse motor ($44) has a front wheel that's adjustable for height.



Shopmate electric (made by Portable Electric Tools) cuts a six-inch swath and has an anti-scalp guard.



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by a lever on the handle, which adjusts the position of the front wheel vertically relative to the chassis. The smaller electric models have little or no adjustment —you tilt the whole unit.

Which one is for you? The more money you spend, the more performance you get. A beefier power supply lets you work faster. But the size of your lawn comes into the picture, too. There's no point in buying a king-size unit for a pint-size

[Continued on page 183]

Some of the gas-powered edger-trimmers you can choose from

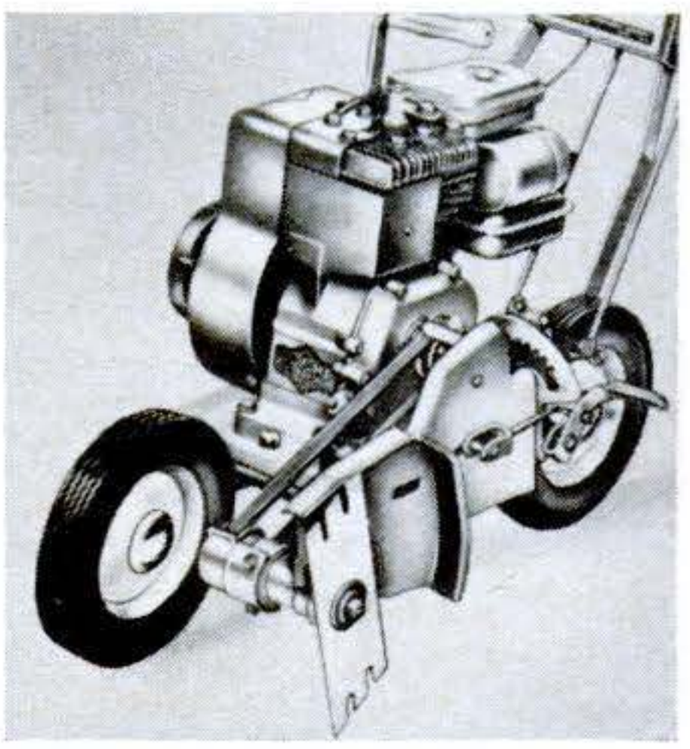
Jacobsen's Pow-R-Edger: 10" blade edges and trims; four-way head; 0-3" edging depth; 0-4" trim height; 2 hp. Under $100.

Goodall 760 edger-trimmer: Two 10" blades; five-position cutting head; fold-down frame; debris deflector; 3 hp. $148.

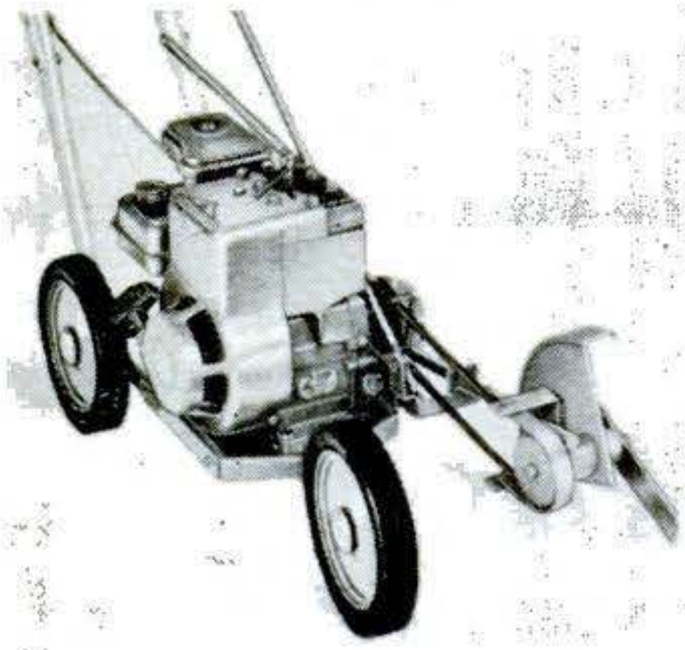
Lawn Boy 1013: Shielded blade edges to 3" depth set vertically, trims 9" swath set horizontally; fingertip geared starter; 3½ hp. $80.

Sears Craftsman: 9" blade swivels 110-deg. for beveling in edge or trim position; recoil starter; 3½ hp. $88.50. Others down to 2 hp.

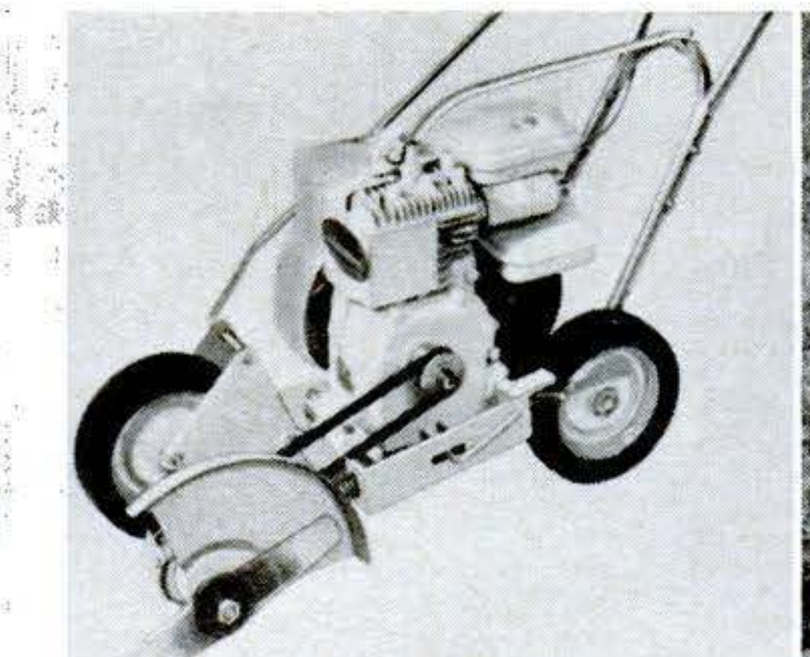
AMF/Homko 5399: 9" blade. blade-stopping clutch; fingertip control for height, depth, and blade speed. 2½ hp. $80.



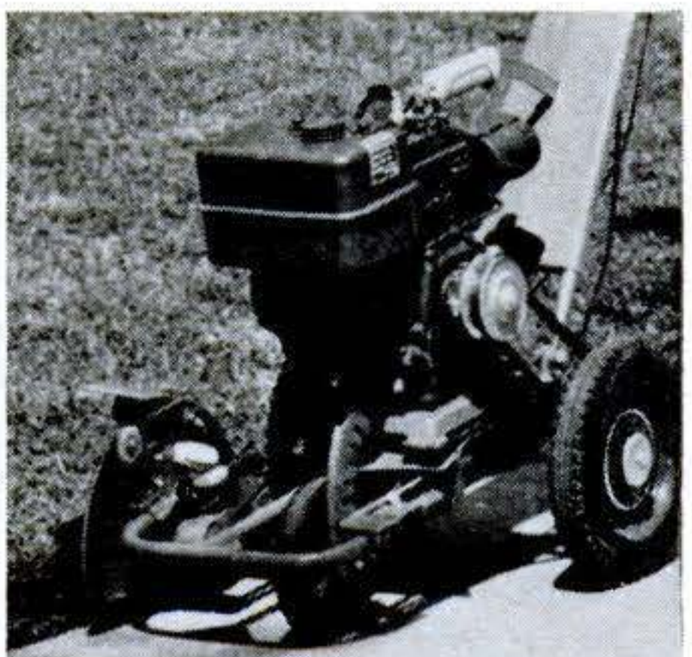
Cooper Edge'N Trim: 9¼" blade; 10 cutting heights; movable front wheel; blade positioner on handle; recoil starter; 2½ hp. $95.



Atlas B-10: 9" blade with six-position adjustment for edging, trimming; crank to change cutting height; recoil starter; 2 hp. $85.



Little Wonder: 10" blade; 120-deg. head adjustment; trim-height crank; 2 hp. $76. With all stand-up controls, $90.



Toro attachments for $85 3-hp. Power Handle: 10" blades; five height/depth positions on $70 Estate; seven on $50 Suburban.

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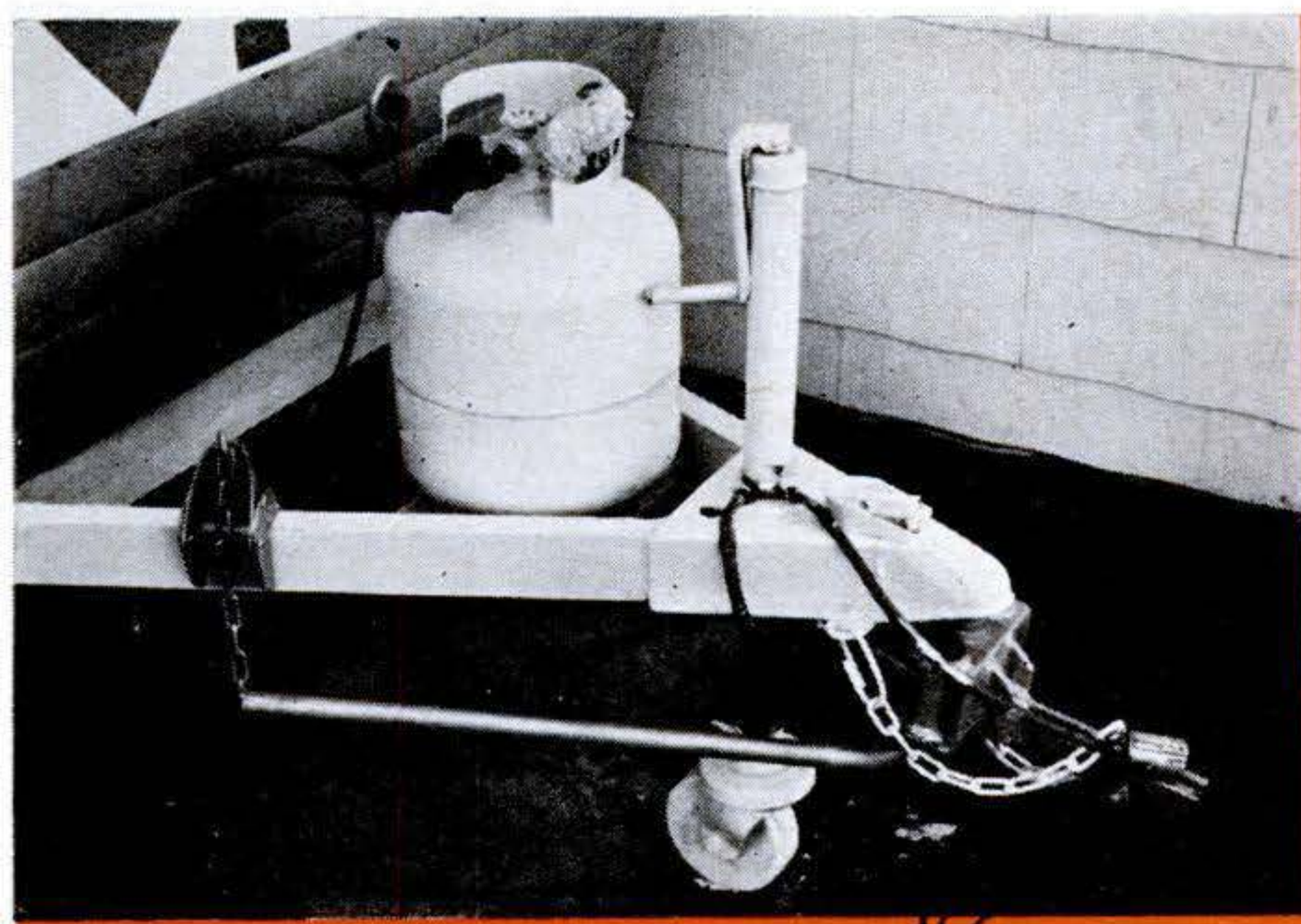
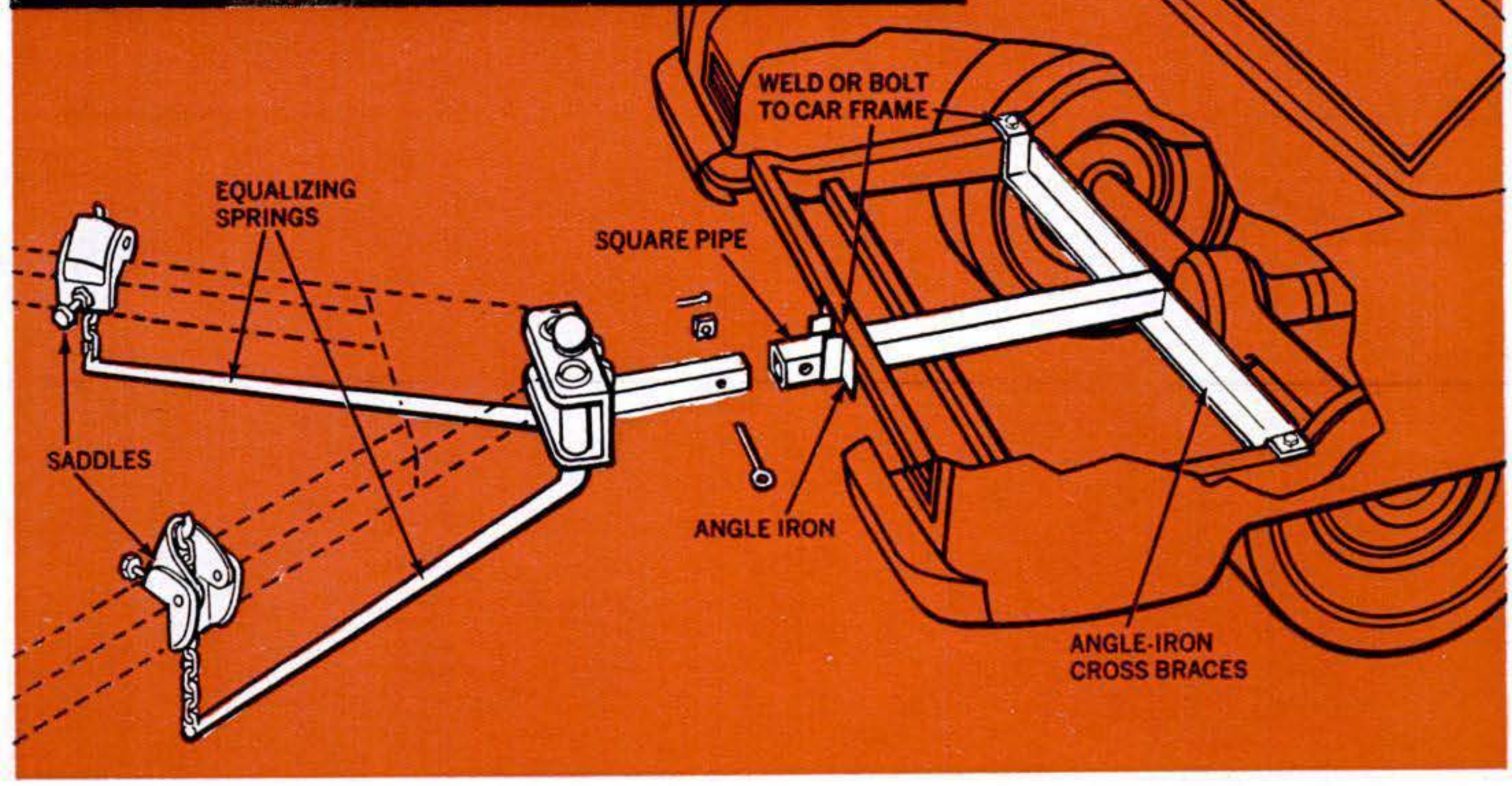


Hitch is attached with heavy angle-iron braces bolted or welded to the frame of the car.



Load-Equalizing Trailer Hitch You Can Make

Trailer towing's a cinch with this hitch. It takes less than $15 in parts. Just weld 'em up

By ARMIN F. GIMBEL

If you tow a heavy trailer behind your car, you need a load-equalizing hitch. It's easier on your car, and it makes driving easier, too. This kind of hitch shifts the trailer-tongue load so that it's not all on the rear car wheels; it's equally distributed between the front and rear axles of the car and trailer axle.

But one can cost anywhere from $60 to $150 installed on your car. Here's how you can make your own for less than $15 by welding up some steel scraps. The blueprint on the following two pages shows you how to build it.

The main parts of the hitch are the load-equalizer springs. I made

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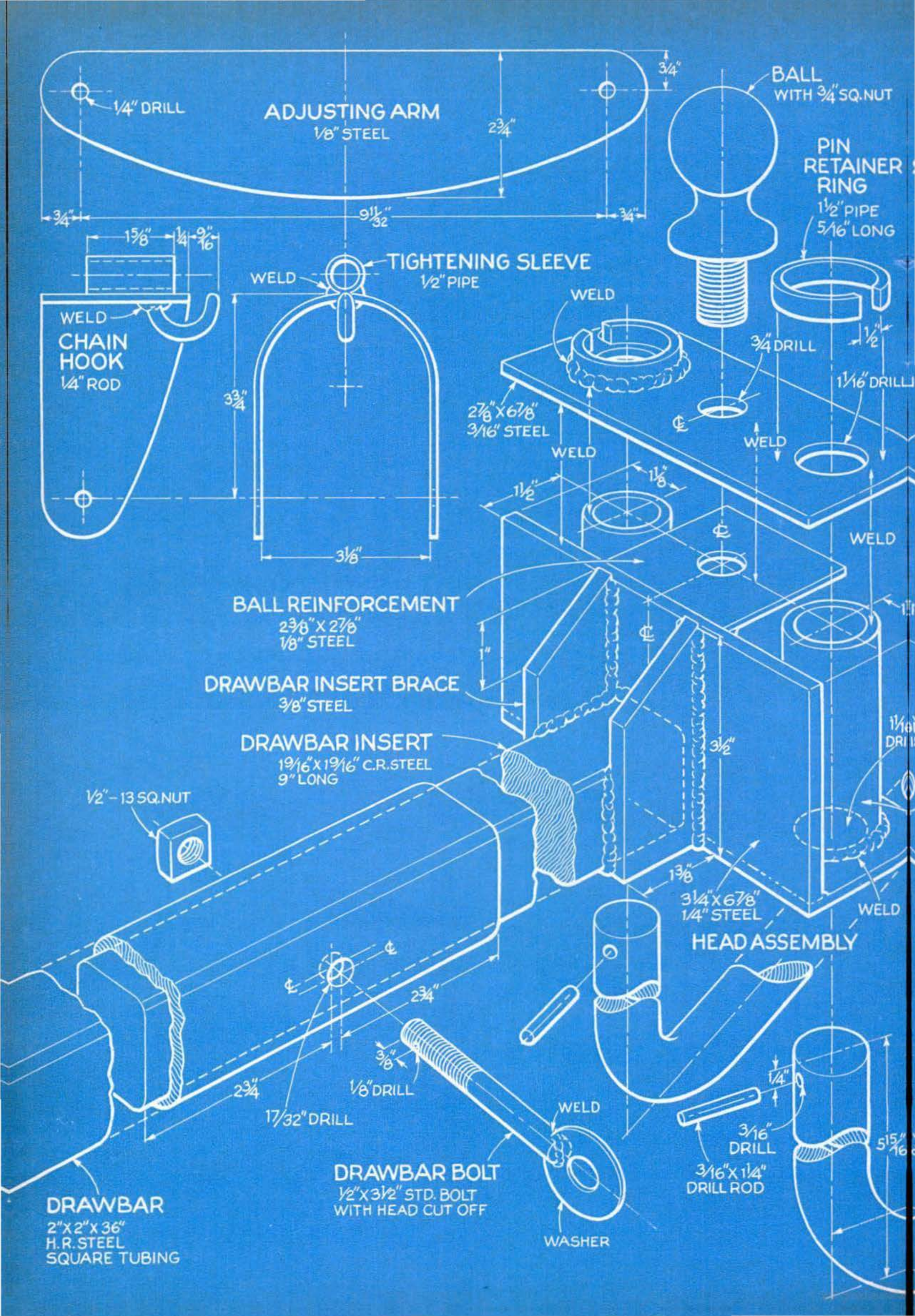
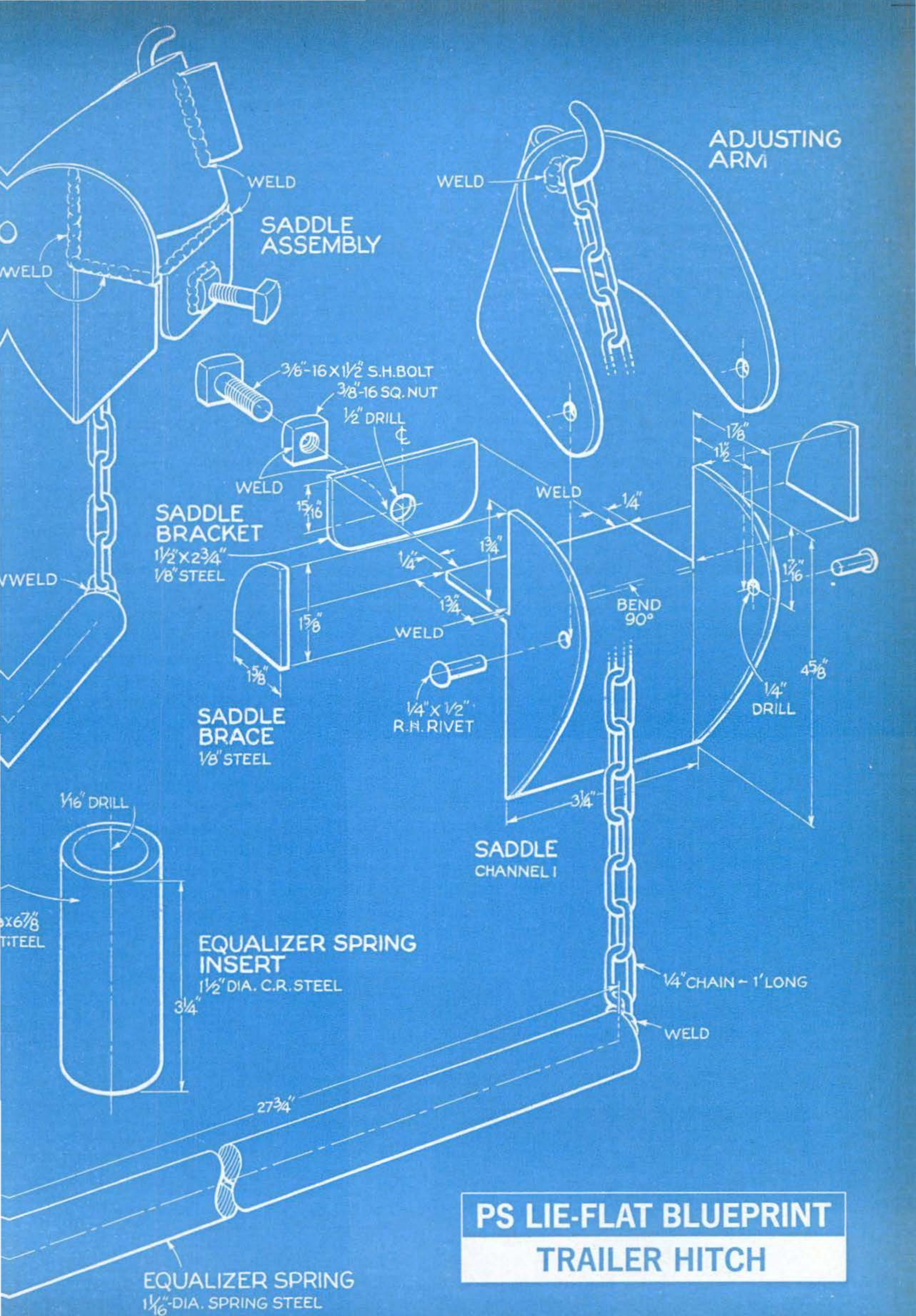

ADJUSTING ARM
1/8" STEEL
1/4" DRILL
2 3/4"
3/4"
9 11/32"
3/4"
3/4"
BALL
WITH 3/4" SQ. NUT
PIN
RETAINER
RING
1 1/2" PIPE
5/16" LONG
1 5/8"
1/4
9/16
WELD
CHAIN
HOOK
1/4" ROD
3 3/4"
TIGHTENING SLEEVE
1/2" PIPE
WELD
3 1/8"
WELD
3/4 DRILL
1/2
1 1/16" DRILL
2 7/8" X 6 7/8"
3/16" STEEL
WELD
WELD
1 1/2"
1 1/8"
WELD
BALL REINFORCEMENT
2 3/8" X 2 7/8"
1/8" STEEL
1"
DRAWBAR INSERT BRACE
3/8" STEEL
DRAWBAR INSERT
19/16" X 19/16" C.R. STEEL
9" LONG
3 1/2"
1/2" - 13 SQ. NUT
1 3/8"
3 1/4" X 6 7/8"
1/4" STEEL
WELD
HEAD ASSEMBLY
2 3/4"
3/8"
1/8" DRILL
2 3/4
17/32" DRILL
WELD
1/4"
3/16"
DRILL
3/16" X 1 1/4"
DRILL ROD
DRAWBAR BOLT
1/2" X 3 1/2" STD. BOLT
WITH HEAD CUT OFF
WASHER
DRAWBAR
2" X 2" X 36"
H.R. STEEL
SQUARE TUBING


WELD
SADDLE ASSEMBLY
WELD
ADJUSTING ARM
WELD
3/8"-16 X 1 1/2" S.H. BOLT
3/8"-16 SQ. NUT
1/2" DRILL
℄
WELD
SADDLE BRACKET
1 1/2" X 2 3/4"
1/8" STEEL
15/16"
WELD
1/4"
1 3/4"
1/4"
1 3/4"
1 5/8"
WELD
1 5/8"
1 7/8"
1 1/2"
1 7/16"
BEND 90°
4 5/8"
1/4" DRILL
1/4" X 1/2" R.H. RIVET
SADDLE BRACE
1/8" STEEL
3 1/4"
SADDLE
CHANNEL I
1/16" DRILL
EQUALIZER SPRING INSERT
1 1/2" DIA. C.R. STEEL
3 1/4"
1/4" CHAIN - 1' LONG
WELD
27 3/4"
EQUALIZER SPRING
1 1/16"-DIA. SPRING STEEL
PS LIE-FLAT BLUEPRINT
TRAILER HITCH

these from Plymouth torsion bars I got at a junkyard for $3 each. The rest of the hitch is cold-rolled steel.

Saddle assembly. Make the two saddles out of channel iron or two angle irons welded together. Cut the curved sides on a metal bandsaw; then hacksaw a 1¾″ cut down each corner for the right-angle bend. Make the bend by holding the channel iron in a vise and pounding the cut section over with a heavy hammer. Weld the two saddle braces inside the bend, the nut over the ½″ hole in the saddle bracket, and the bracket to the saddle.

Bandsaw the two adjusting arms. Bend the radius over a piece of pipe of the right diameter. Weld the sleeves to the adjusting arms, and rivet the arms to the saddle. Peen over the rivets, but not so tight as to prevent the adjusting arm from being turned.

Drawbar head. Cut out and drill the top, bottom, and side plates for the head assembly. Tack-weld them together lightly. Machine the equalizing spring inserts and tack-weld them in place. Tack-weld the pin-retainer rings. Position them as shown in the blueprint with the cutouts facing the sides of the hitch. Tack on the drawbar insert. You can vary the position of the drawbar insert to let the height of the hitch match the trailer tongue. Position and tack-weld the drawbar insert braces and the ball-reinforcing plate. Check the position of all the parts and do the final welding.

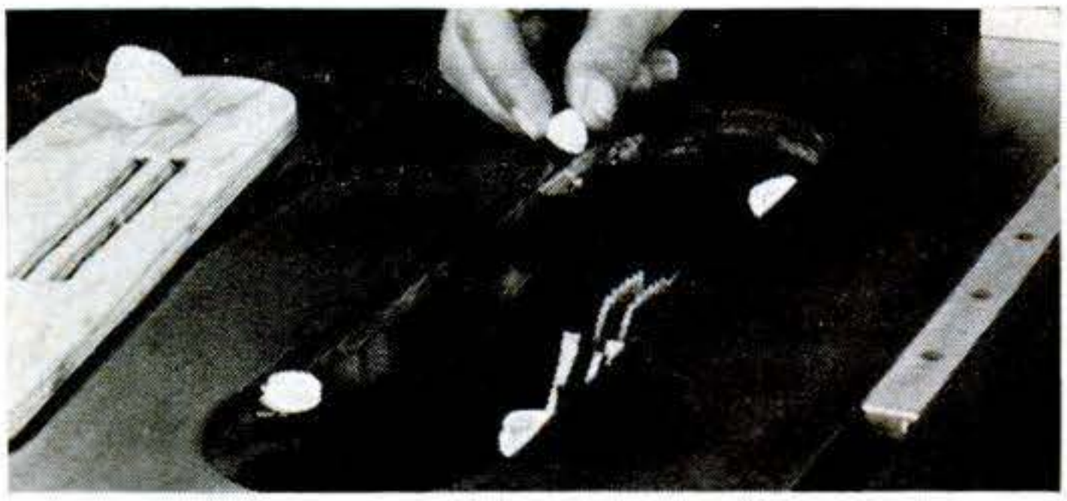
Equalizer springs. Make two of these from a torsion bar from an old Plymouth. Anneal the end of the bar by heating it cherry red and letting it cool slowly. Drill the ends of the spring bars to take the retainer pin. Bend the equalizer springs (use finished drawbar as a holder) and heat-treat them. It's best to check the hardness of the bar on a Rockwell tester. But if a Rockwell tester is not available, use an oil quench of 750 degrees to get a satisfactory hardness. Weld the chain to the ends of the bars.

Drawbar insert. This is a piece of square steel 9″ long. File enough radius on the edges to allow a snug fit in the square pipe drawbar. It's a good idea to drill the 17/32″ hole after the insert is fitted into the drawbar. The drawbar bolt is a ½″-by-3½″ standard bolt with the head cut off, the end slotted, and a washer welded into the slot. The washer makes it easy to grip and remove the bolt with your fingers.

The drawbar is a length of 2″-square pipe which is welded to two angle-iron crossbars as shown in the drawing on a previous page. The crossbars are welded or bolted to the frame of the car.

Hitching up. To use the hitch, dab a little grease on the ends of the bars and insert them in the sockets. By turning the bars at right angles to the hitch, you can insert the retainer pins in the ends of the spring bars. The retainer rings will keep the pins from falling out when the spring bars are in use position. Mount the trailer tongue on the ball. Hook the saddle assemblies on the trailer frame so that the chain hook is directly above the chain end of the equalizer spring. Tighten up both bolts. Then, with the adjusting arm in the low position, slip the chain over the hook.

The link you use is determined by the amount of lift you have to put on the rear of the car to keep it from sagging. The shorter the chain is hooked, the more lift you have. It's best to have the height of the hitch ball close to the height of the trailer frame. Then insert a jack handle in the tightening sleeve and cinch up on the chain until the arm goes beyond center and holds itself. With both chains cinched up, you're ready to roll. PS



Putty helps to level table saw

When you make a special insert for your table saw, and have trouble leveling it, try this trick. Put a dab of putty on each of the ears that support the insert. Make the putty balls larger than necessary, and press down until the insert is level.

R. J. De Cristoforo, Los Altos Hills, Calif.

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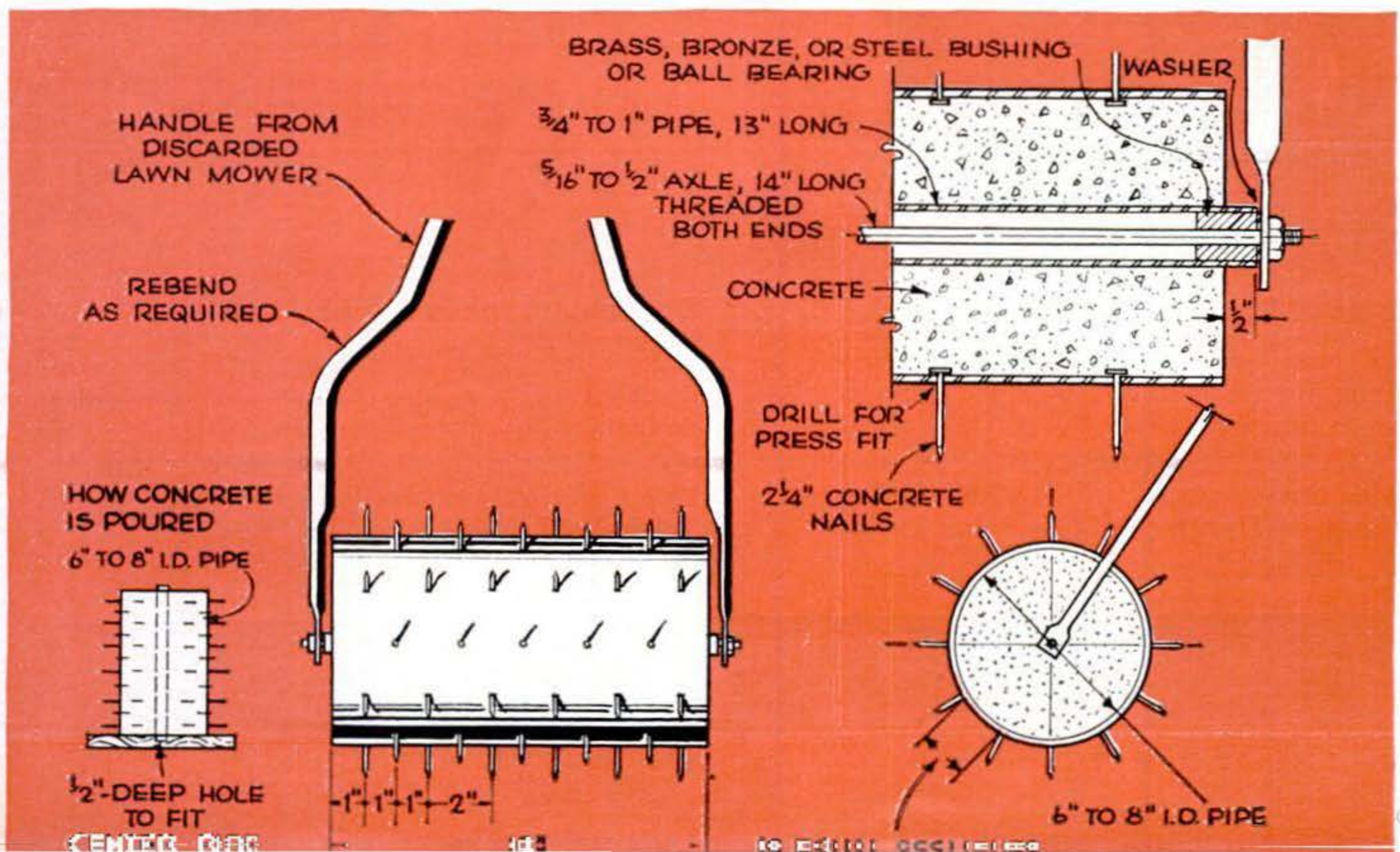
How to Make Your Own Lawn Spiker

By PAUL SCOTT

A lawn spiker is often a cure for sparse spots on your lawn caused by compacted soil. It breaks up the soil and lets oxygen and nutrients get down to the grass roots.

This simple spiker is just a junked lawn-mower handle, a piece of ¾″ or 1″ pipe, and a piece of 6″ to 8″ pipe. The inner pipe—for the axle—is located by fitting one end into a ½″-deep hole bored in the wood forming the bottom of the mold. Roughen the outside of this pipe so the concrete when poured will adhere better. Drive hardened concrete nails through the outer pipe as shown in the drawing. Center the assembly carefully, and pour in the concrete. Allow at least two days for the concrete to harden. When using your spiker, you can vary the penetration by pushing (when teeth dig in deeper) or pulling it.



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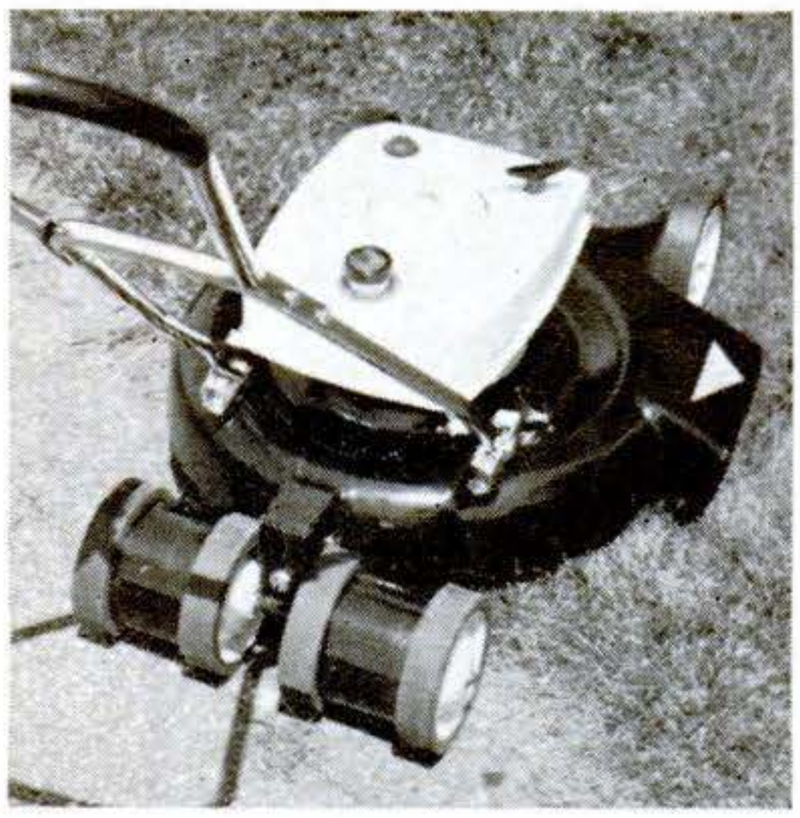
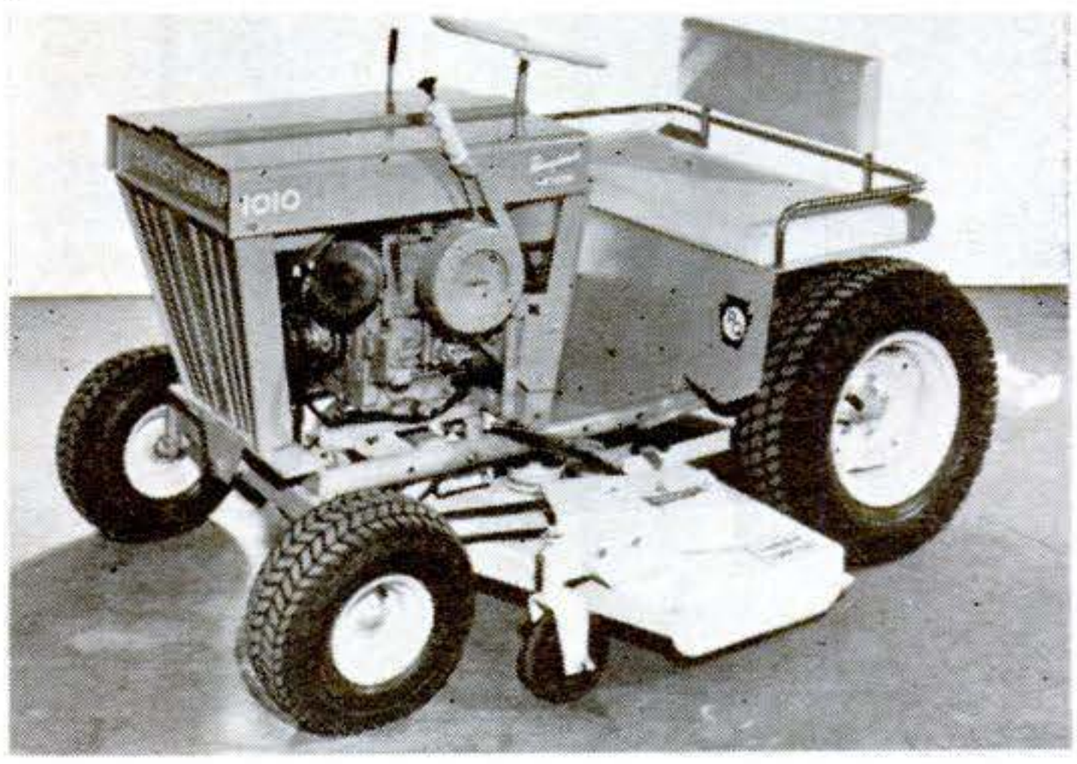
What's New for the Home



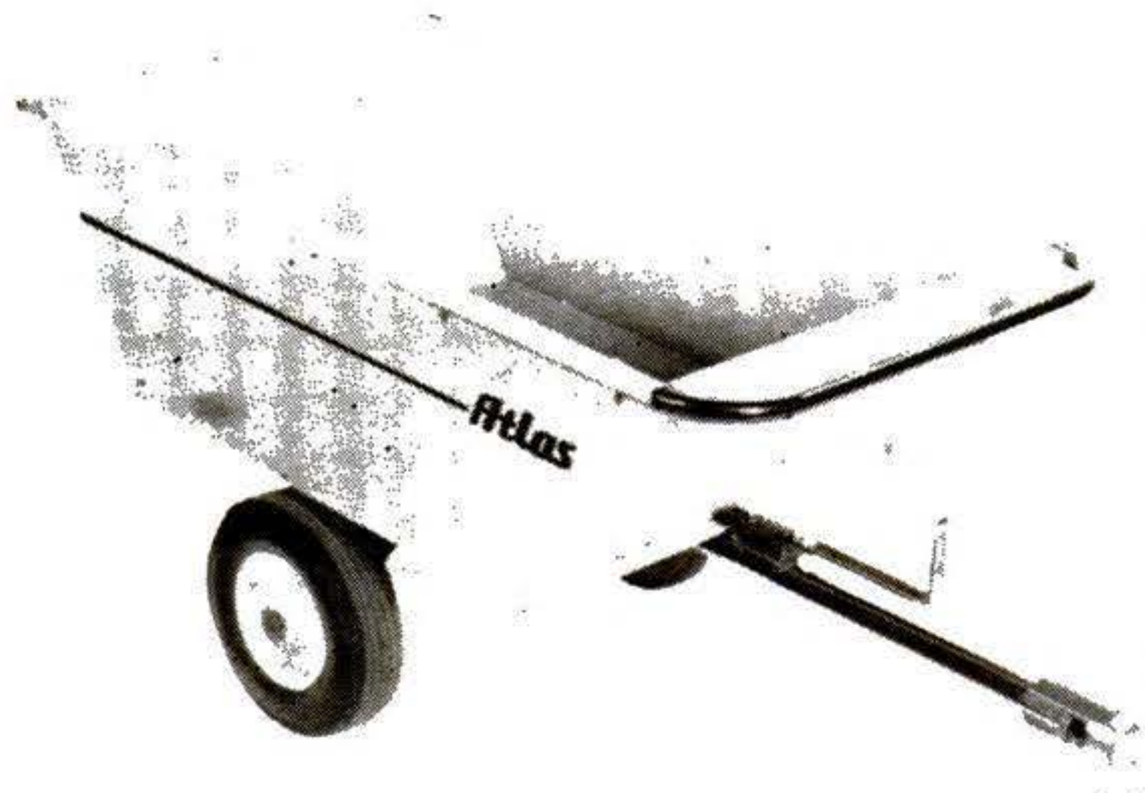
Two ways to protect your tootsies when you're hiking behind a mower

The roller at the rear of the Rolls Safe mower at left keeps you from dragging the mower over your toes, fends off flipped stones, and makes slope mowing easier. The Lazy Boy Mower Co., Kansas City, Mo., makes it. The Pro-Tek-To toe caps (right) are made of high-strength plastic. They slip right over your shoes and are held on by tension straps. Osborn Mfg. Co., Warsaw, Ind. For men, $4.95; for women, $3.95.



Outboard mower for a tractor

If you own a Meteor tractor (made by Pennsylvania), you can now buy this 48" side-mounted mower for it. The attachment is a three-blader with cutting height adjustable from 1" to 3". The start-stop controls mount on the tractor's dashboard.



Dump cart takes big payload

You can haul 300 pounds of leaves, compost, or dirt in this dump cart for riding mowers. The dump lever can be reached by the operator without leaving his seat, and the bed locks automatically when repositioned. Atlas Tool & Mfg. Co., St. Louis, Mo.

TO REMOVE SECTION, open magazine wide at this page, rest it on table, run your thumb firmly along center fold. Then pull out the sheets gently, one at a time.

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Pull-out Save-it SECTION

HOME-PLUMBING KNOW-HOW

How to Open Clogged House Drains

Part Two

By GEORGE DANIELS and LOYD WEAVER

When you can't clear a clogged drain with a force cup or chemical cleaner, you need the positive action of a plumber's snake—a long, spring-metal tool you push through the pipe. It's limber enough to go around elbows in the line, yet stiff enough to dislodge stoppage.

In its most flexible form, it consists of a steel-wire core wrapped spirally with wire like a speedometer cable. At the head end, the wrapping is enlarged to arrowhead form, often with a corkscrew tip. (Professional ones may have interchangeable tips for special jobs.) On budget types, a tubular crank with a locking thumbscrew slides along the auger. You can tighten it at any point to rotate the portion of the tool inside the pipe. This helps it around elbows and provides boring as well as pushing action.

Augers range from ¼″ to ¾″ in diameter, from 6′ to 100′ or more in length. In general, the greater the length the larger the diameter. For the usual home plumbing jobs a 25-footer of ⅜″ diameter is a good choice. (A special "closet" or toilet auger, operated through a J-shaped tube, is used to clean clogged toilets.)

Prices run from less than $1 for economy six-footers to around $3 for 25-footers, about $1.75 for toilet types. So it pays to have them around for emergencies. The fat 100-footers used for house sewer cleaning cost around $60. But you can rent them for as little as $2 a day.

The other common type of snake is a plumber's or sewer tape, sometimes also called a rod. This is flat spring-steel ¼″

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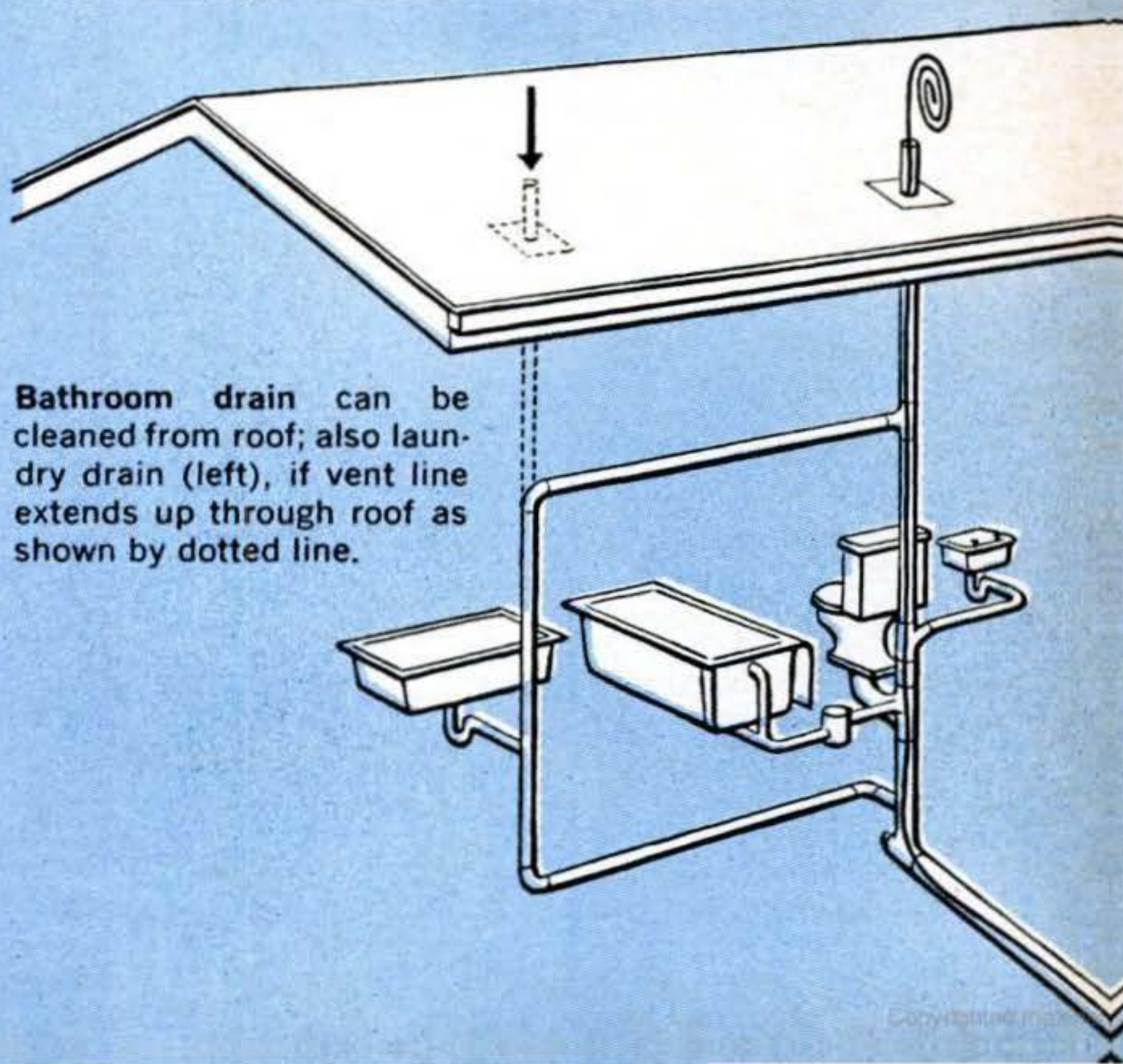
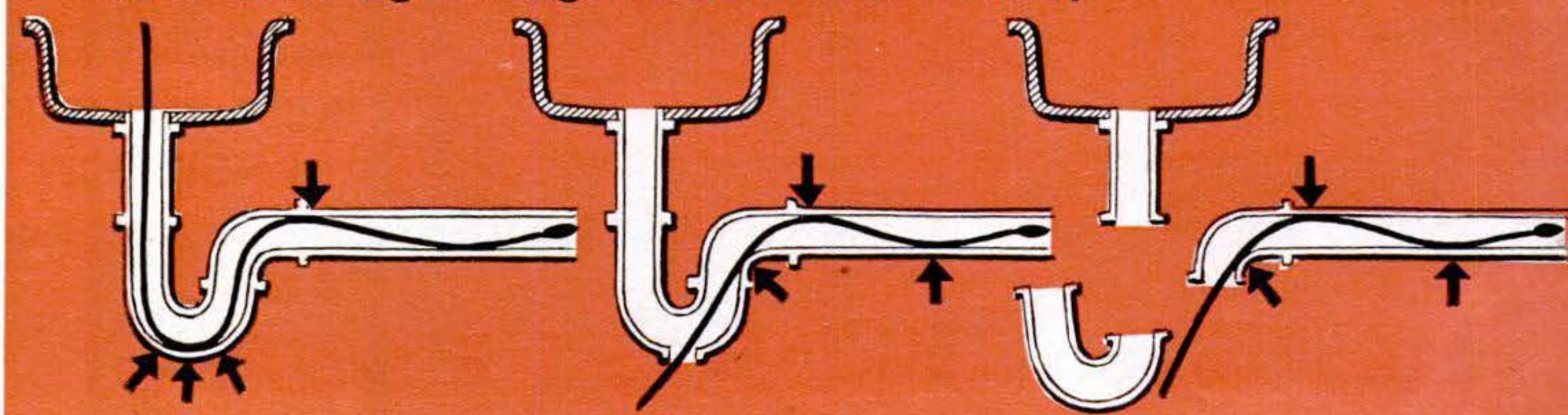


Bathroom drain can be cleaned from roof; also laundry drain (left), if vent line extends up through roof as shown by dotted line.

How to run an auger through the drain line of a lavatory



Auger is slowed by greatest number of friction points (arrows) when inserted through drain. Less are met when it goes through clean-out, and fewer when you remove the U-shaped trap entirely.

to ¾″ wide, usually 25′ to 100′ long, coiled in an iron frame. It can flex in only two directions (through the thin dimension of the tape). To help guide it through the pipe, you can tip the frame from which you are unreeling it. Length for length, it costs less than the spring-type auger, typically, around $6 for a 50-footer half an inch wide.

(Another push-through drain-cleaning tool is the true sectional sewer rod, made up of coupled lengths. Typically, these aren't flexible enough to take right-angle elbow turns, so you're not likely to be using one.)

How to start. If you're working on a sink, washbasin, or laundry tub, and you suspect the stoppage may be in the trap under the fixture, you may get a quick fix by pushing a ¼″ drain auger down the drain opening into the trap. If the fixture has a mechanical stopper mechanism you'll have to remove any parts obstructing the snake. The auger will go around the U bend in a trap, but may hang up on the next connection, between trap and drain line.

If the fixture begins to drain, the job's done. If not, don't try to force the auger; bail out the fixture. Then place a bucket under the trap beneath it, and remove the drain plug at bottom of the trap, if there is one. The water left in the trap and pipe will drain into the bucket. You can then insert the snake through the drain-plug opening and feed it into the drain line beyond.

If there is no drain plug, you must remove the U portion of the trap. This section of a modern trap is connected at the fixture end by a slip-joint nut, and at the drain-pipe end by a union nut. Both can be disconnected by turning the big hex nuts. The pipe doesn't turn. You simply wiggle the disconnected U portion to free it. Then you can feed the auger directly into the drain.

Important: Before removing drain plugs or connecting nuts, wrap them with some stick-on tape to protect the chrome finish. And insert a wrench handle or a strong stick through the U to apply pressure in the direction opposite to that of the wrench. This prevents twisting or breaking of the thin-walled trap. If the big hex nuts won't budge, hold a hammer against one of the flats on the hex, and tap the opposite one with another hammer to loosen corrosion.

How to use a drain auger. First take a look in the basement area below the fixture—if plumbing there is exposed. You can usually find the soil or waste stack leading down from the same wall on which the fixture drain leads. The horizontal distance from the fixture drain location to this waste pipe gives you an idea of how much auger you'll need to reach from where the pipe enters the drain line to where it emerges into the larger waste stack. When the auger has reached this far, you have either broken through the stoppage or pushed it into the larger pipe, through which it can pass on to sewer or septic tank.

If basement plumbing isn't exposed, you can often spot the soil or waste stack by locating the waste vents through the roof. The course of the pipe inside the wall may vary from the length of the drain

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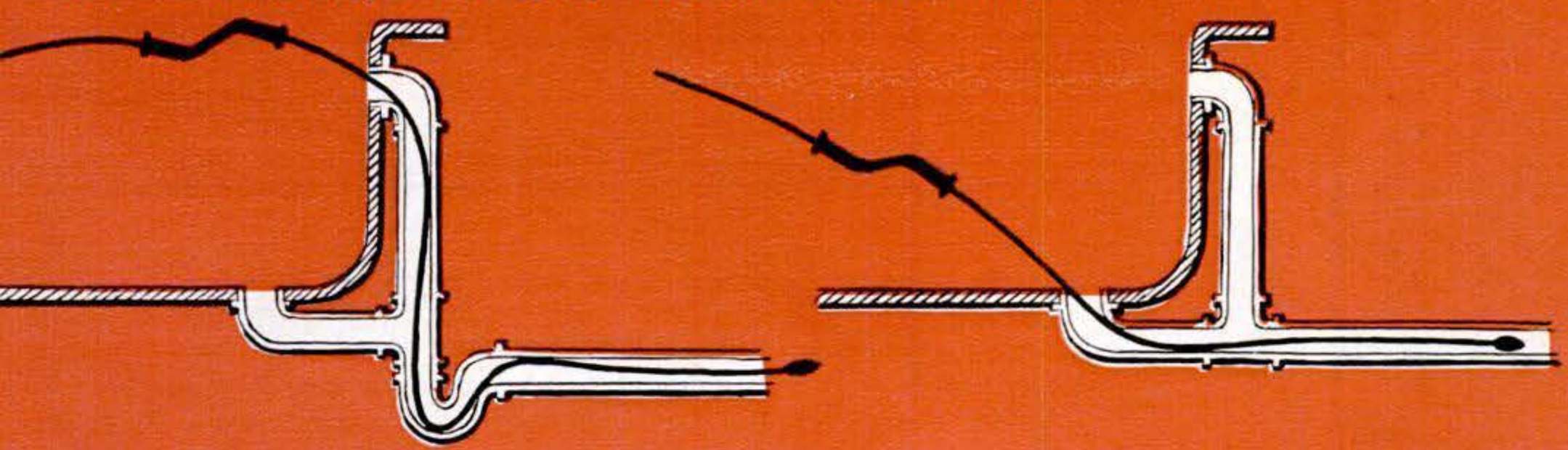
How to run an auger through your bathtub's drain line



ere the snake should enter—through drain or **rflow opening**—is determined by drain layout. In either case, you'll have to remove the overflow-valve mechanism first, as described last month.

line, but you can estimate it closely enough. If there's a long, exposed run of pipe, look for a clean-out plug along it. Or drill a hole through an elbow, and insert the auger backwards—so the end without an expanded tip passes through the hole. Tap and plug the hole afterward.

Feed the auger into the pipe about 6″ at a time. It will slide in easily until it reaches the stoppage or a turn in the pipe. When it is slowed or stopped, rotate it clockwise with its crank handle. The screw action of the wire wrapping and tip helps work it forward around elbows or into stoppages. After rounding an elbow, the auger can usually be slid back and forth in a pipe more easily than after entering a stoppage. So if it moves fairly easily, keep feeding it in. When progress is sluggish, crank it.

If your system has drainage-type fittings, they'll guide the auger in the outflow direction even where the drain joins an upward vent pipe and a downward waste pipe at a T, as the internal surfaces of drainage fittings are contoured in the outflow direction. If a straight T was used (in a codeless area) the auger may go either way, perhaps up the vent instead of down the drain. If you've used enough auger length to reach the vent but haven't cleared the drain, have someone crank the auger while you hold your ear to the wall to find which way it's going.

Keep a bucket handy. Water is held in the drain by the stoppage, so keep a bucket under the open end to catch any forced out by auger displacement. When the water in the pipe suddenly recedes, you've probably cleared the pipe. Use a funnel and a piece of rubber hose (slipped a few inches into the pipe) to double-check without removing the auger. If water run slowly into the pipe drains away with no overflow into the bucket, the big job is done.

Now just slide the auger back and forth in the pipe so the tip traverses the point

Continued

A special auger opens up a toilet bowl

Stoppage is almost always at narrowed portion of trap that provides water seal. Most positive method of removing it is with toilet auger. Start auger up into blocked passage with tube portion of tool near back of bowl, and crank auger as it moves into blockage. If trap is to rear, reverse tool procedure.

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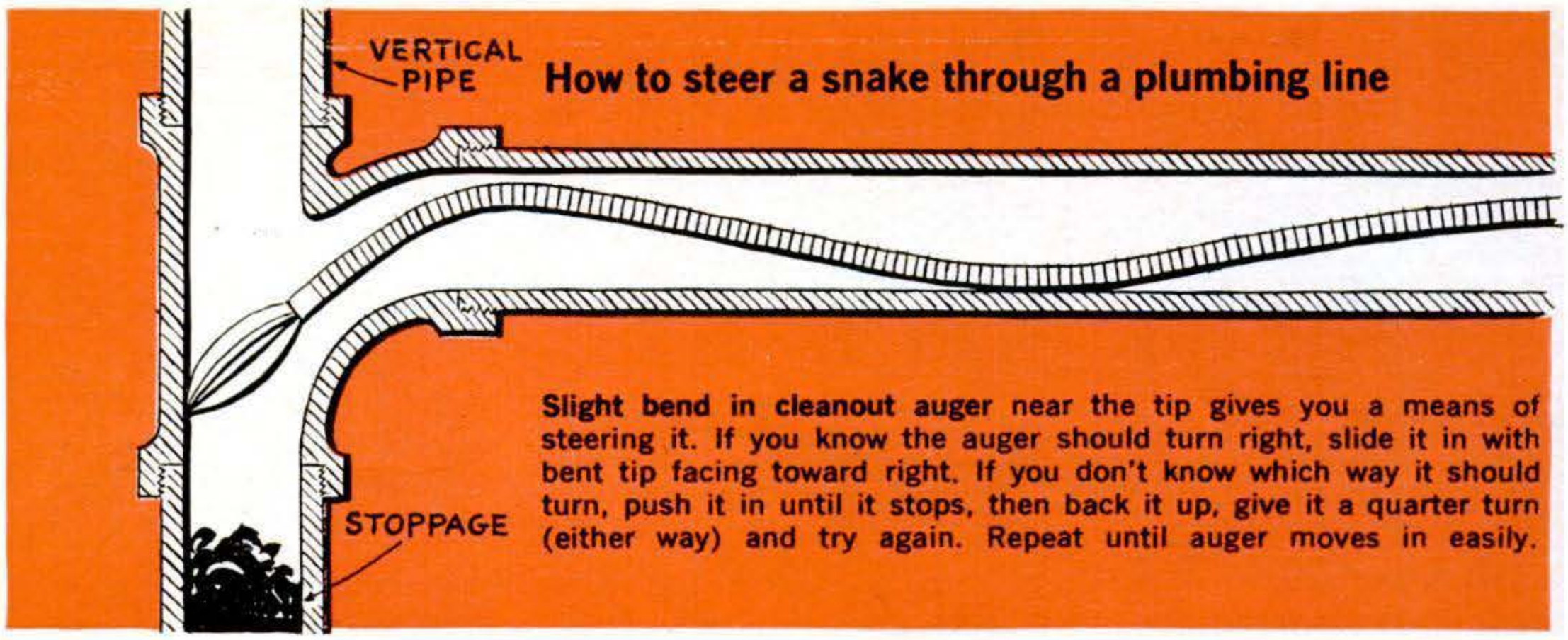

it had reached when drainage began, and keep cranking. This scrapes away material still clinging to the inner walls of the pipe at the stoppage point. Leave the bucket or layers of newspaper under the drainpipe opening as you remove the auger. Then fold a rag wad around the auger to wipe it clean as it slides out.

When you reassemble the trap, check the rubber washers in the connecting nuts. If cracked or broken, replace them with matching new ones, if available. If you can't match them, use a few turns of ordinary cotton cord—or wicking from a plumbing supplier. It swells when wet.

When all connections have been tightened, run very hot water through the drain (unless you have plastic drainage plumbing). If the drain has a history of stoppages, forestall trouble by using a solvent-type drain cleaner at intervals.

Auger tricks. You can often "steer" an auger more easily through turns in a drain line by bending the auger tip a bit. When the auger stops cold, back it up slightly, give it a quarter turn, and push forward again, repeating a quarter turn at a time until it moves ahead. At some point in the rotation, the tip will be pointing in the direction of the turn in the pipe, and will usually move ahead more easily. The slightly bent tip also helps the auger past the projecting interior shoulders of fittings, when true drainage fittings have not been used.

Bathtubs require another technique, as the trap is not always accessible. As in a washbasin, mechanical stopper parts that block the auger must be removed. The auger may be inserted through the drain outlet or the overflow opening. If it balks at one, try the other. A drum-type trap will usually stop the auger.

Finding the trap. If you can't clear the stoppage by feeding the auger through the tub drain or overflow, look for a means of access to the trap. If it isn't the point of stoppage, it may at least provide a good auger entry point to reach it. In an unfinished basement, the trap of a first-floor tub is likely to be between ceiling joists. On upper floors, it's often behind a removable panel, perhaps in a closet on the other side of the wall against which the tub is set.

If you can't find it, check with the builder or plumber who made the installation. Sometimes, traps are accessible only by opening a wall or ceiling. If yours is walled in, you can probably spot it by removing the baseboard from the wall beside the tub (drain end) and making an inspection hole. When the baseboard is put back, the hole won't show.

Location usually determines how you open or remove a trap. Drum traps reached from above usually open at the top. Those reached from below usually open at the bottom. Where a trap presents a major problem, such as opening a ceiling, look for an easier clean-out means, like the pipe-elbow drilling mentioned earlier. If you can clear the lines to and from the trap, you can usually eliminate the stoppage.

Before loosening any trap or connection, of course, bail out the tub. If it's full, speed the job by siphoning it out with a garden hose led through the window. Then loosen the trap cover or connection *slightly* to let water remaining in the line empty into a pail. Above a fin-

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ished ceiling this may have to be a stop-and-start procedure, using a shallow pan.

Clogged toilets usually create an emergency situation by flooding the floor. After stemming the flood, look for any visible object protruding from the outflow opening in the bottom of the bowl. If nothing is visible (and a force cup doesn't help, as described last month) you need a toilet auger. This is a short auger operating through a J-shaped tube that can be extended down into the bowl.

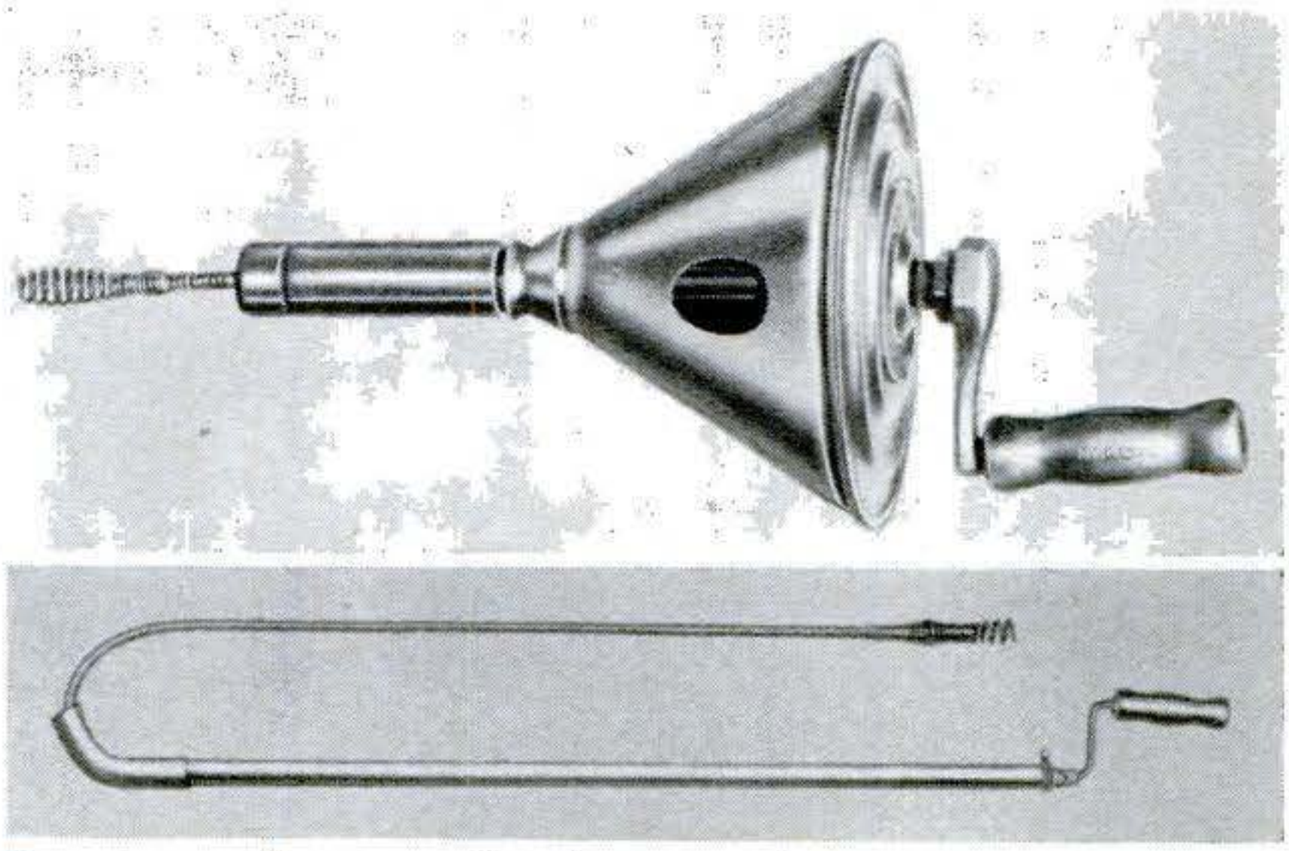
Using a toilet auger. First pull the crank handle upward out of the hollow tube to draw the flexible auger back toward the lower end of the J. Then lower the auger into the bowl so the flexible tip extends into the outflow passage. Crank it clockwise while applying hand pressure to work the rotating tip into the passage. When the auger bites in, try pulling back on it slowly. It's often easier to draw an object back into the bowl for removal than it is to push it into the soil pipe. And there's no chance of it lodging farther along.

If stoppage is caused by material like wadded paper towels, it can be broken up more easily when wet, so leave a normal water level in the bowl. If a floating object like a rubber ball is causing the trouble, bail the bowl empty so it won't float back into the passage when freed. If you don't know what the stoppage is, try working wet first, then dry.

When a considerable mass of material is drawn back into the bowl and removed, or when the auger feels free, as if the stoppage has been pushed through, you can check to see if all's clear by pouring water into the bowl. If the bowl level remains normal, even with fast pouring, the stoppage is gone. Until you can rapidly pour in a bucketful of water without the level rising abnormally, flushing is unsafe.

Unclogging a house drain. A clogged main waste-outflow pipe usually requires a major clean-up and bail-out job before clearing work begins. If the stoppage is porous, the back-up may drain through slowly to the sewer or septic tank. If this seems to be occurring, wait for complete drain-out, even if it takes several hours. You'll save a lot of messy work. If it doesn't drain away, bail it out and pour it into a tub-sized hole dug outside. Sanitary codes usually forbid emptying sewage into a storm sewer.

There's often a cleanout plug in the drain outside of the house where you can insert a plumber's tape, as here, or an auger.



Two types of augers that it pays a home owner to own are shown here—a hand-cranked auger at top, a toilet auger below.

Continued

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To drain waste pipes, partially open the clean-out plug usually found in the main house drain near its exit from the basement (put a container under it first). You can turn the plug with a wrench to control outflow rate, and shut it off while emptying the container. When flow stops, remove the plug completely to provide entrance for the sewer tape or cleanout auger.

In good weather, you can avoid this bail-out/drain-out by feeding the tape or auger down the roof vent (the open top of the stack). This way, you clear the stoppage without opening the clean-out plug. As soon as the stoppage is cleared, the fixtures drain normally. The rest is a clean-up job.

If you're wary of working on the roof, you can sometimes achieve the same result by feeding the tape or auger backward from a septic tank. This works, however, only with tanks that have inspection lids directly above the inlet T. If you know where your tank came from, take a look at a similar one to see if this clean-out method is feasible.

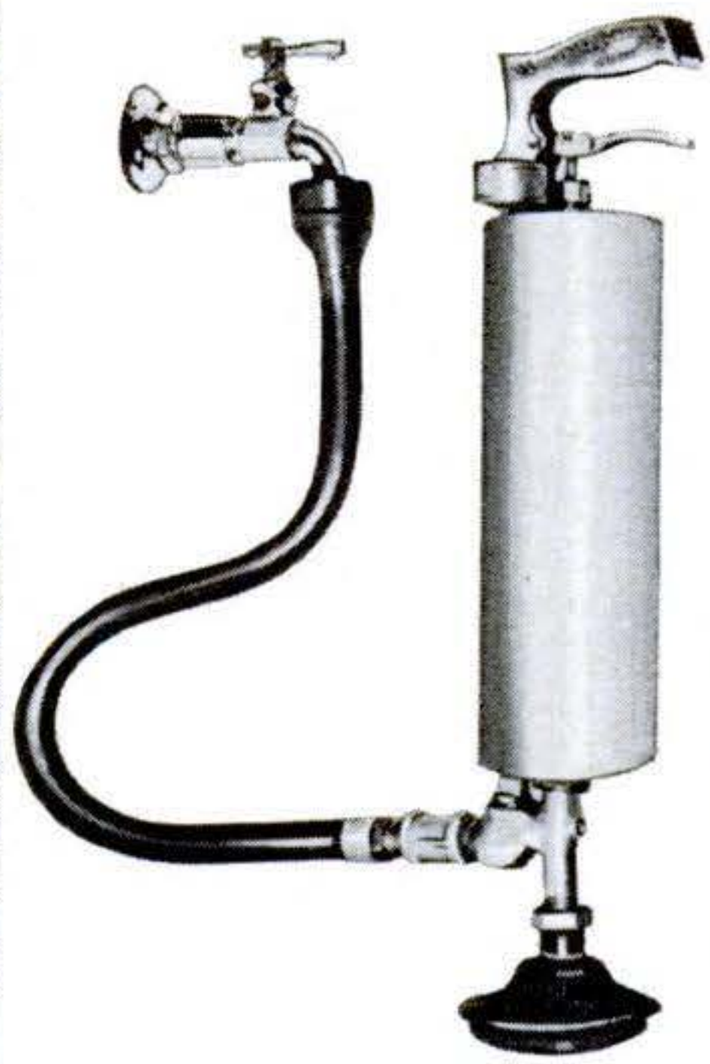
For the actual clean-out, you can buy or rent a ¾″ sewer tape. Or better, rent a ¾″ spring auger that will flex in any direction and can be easily rotated for boring action. The technique is similar to that used with smaller snakes, but requires more elbow grease.

Your best bet, if there's a tool-rental firm in your area, is an electrically operated sewer auger. Sample cost: $3 an hour, three-hour minimum. You'll get full instructions on operating the rental unit. The basic rule: Let the rotating action do the work. Feed the tool ahead gently, don't force it.

Root stoppages. If roots have invaded the pipe, causing stoppage, you can fit the machine with root-cutting tips. In root work, start with a small-diameter cutter and work up to a larger diameter in stages. The first, small-diameter cut makes a channel through which its own and subsequent cuttings can float through the pipe. Water to carry them through is provided by allowing a faucet to run in any convenient fixture as you continue to work.

If you suspect there's a broken piece of pipe in the line, don't use the root cutter. It's likely to hang up on the broken section so you can't pull it out. Then you'll have to dig down to the drain line to free it. And while you're digging, you'll be paying $3 an hour for a beautiful tool you can't use. PS

If roots should clog a drain, remember that you can usually rent the tools needed to clear them out. Here, Gordon Smith, manager of a United Rent-Alls store, readies an electric root-cutting auger for service.



You can harness air pressure to help you clear out drains. Here's an ingenious air gun you pump up with handle on cylinder. Miller Sewer Rod Co., 4642 N. Central Ave., Chicago 60630, makes it.

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Shop Talk

By ROBERT P. STEVENSON

New items that may ease your home-improvement chores

Have your asphalt shingles become dingy? You can perk up the whole house by applying aluminum roof coating developed by Alcoa and marketed by leading paint companies. It comes in several colors . . . You can get a nice batch of remodeling and modernizing ideas and tips from a Homeowners' Remodeling Information Kit created by the American Hardboard Association. Send 10 cents to Sumner Rider, Box 3498, Grand Central Station, NYC 10017 . . . A new Shopmate electric shrub and hedge trimmer has two built-in levels to help you keep cuts vertical or horizontal. It lists for about $35 . . . Like the aroma of cedar in your closet? Try coating it with liquid Cedar-In. For information, write to Thomas M. Ungrady, 35329 Beach Park Dr., Eastlake, Ohio 44095.

Two sticky new products have all kinds of home and shop uses

One of the fringe benefits of my job is the chance I have to check out new products that I might not see otherwise. A few days ago, for example, a representative of Minnesota Mining and Mfg. Co. came in with a nice batch of new adhesive products.

One caught my eye—and imagination—right off. This was a heavy-duty strapping tape, ½″ wide and reinforced with cable-like glass filaments running the full length of the 30′ roll that you buy for 79 cents. The 3M people claim you have to exert a 140-pound pull to break the tape—and I believe it. It's so strong you can hardly rip off a piece, even with the cutter knife that's built into the plastic case. It really sticks, too. And it won't stretch after you apply it. Those qualities, I figured, should make it perfect in gluing jobs where you might have trouble applying ordinary clamps. I tried it in several situations. It works perfectly. My 3M visitor also left behind him several cards of Scotch Brand self-sticking pads. These are just the ticket when you find instructions to cement felt to the bottom of a lamp base, bookends, or other projects. Use the pads on the bottom of table legs, too. The pads come in two sizes—½″ by ½″ and ¾″ by ¾″.

Clear vinyl bags are good for everyone

The clear vinyl bags in which you buy many small tools these days are a plus for all of us. Handy grommets let you hang the bags on a toolboard. The tools are protected from rust and the cutting edges from nicks. Merchants like the bags, too, for they reduce pilferage. Stanley has been bag-packaging small items for several years. Just new is a steel tape 50 or 100 feet long, shown at far left. You can open the die-cast case to clean or replace the tape . . . The three-piece chisel set in the other photo is one of several new bag-packaged tool sets by Kraeuter Tools, 332 S. Michigan Ave., Chicago 60604.

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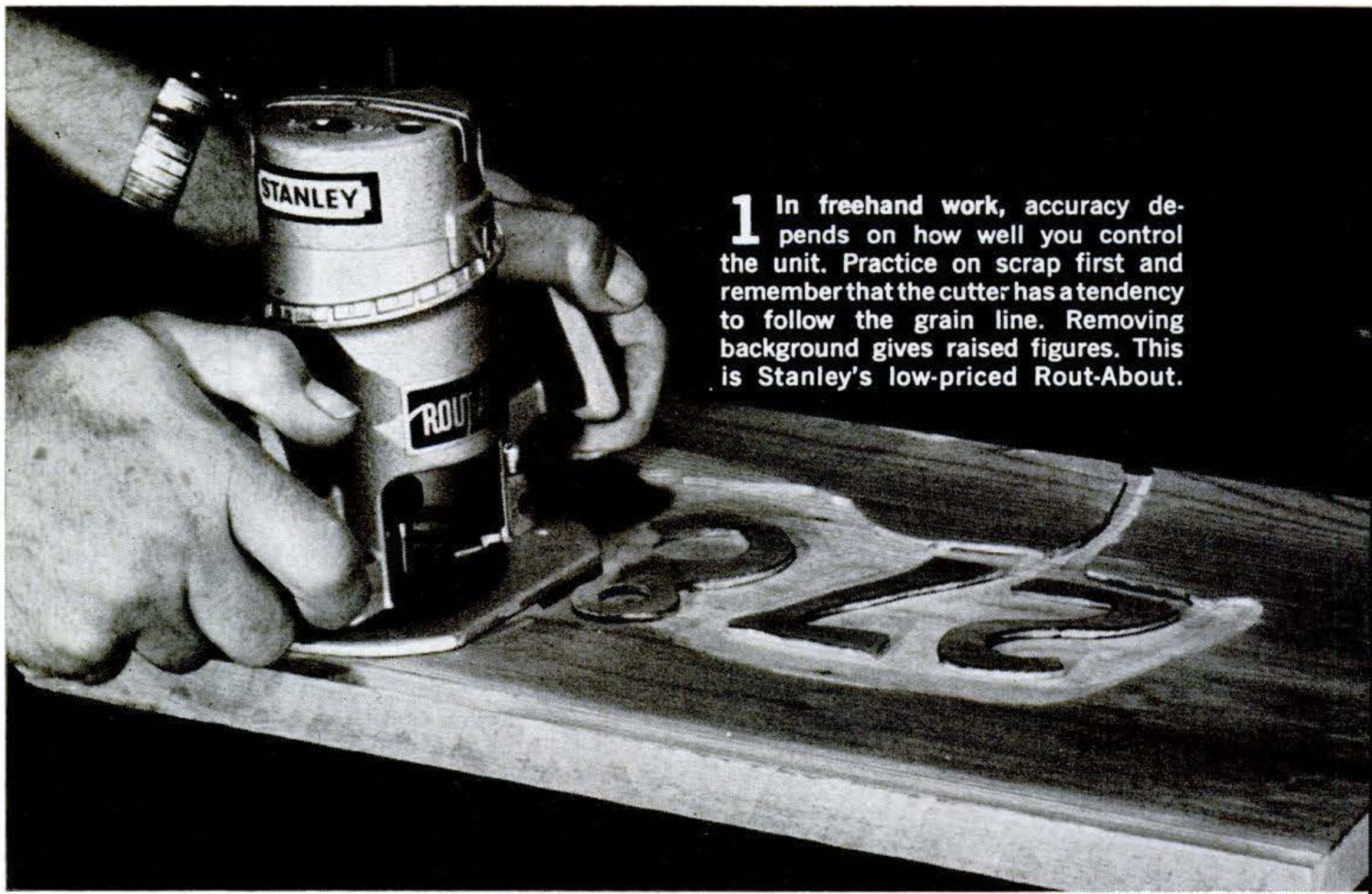

1 In freehand work, accuracy depends on how well you control the unit. Practice on scrap first and remember that the cutter has a tendency to follow the grain line. Removing background gives raised figures. This is Stanley's low-priced Rout-About.

19 Smart Tricks with

Two economy models now give you the chance to get going with this fine woodworking tool

The fact that few professional cabinet shops are without a router is a good tip-off for you. As soon as you begin to take woodworking really seriously, you find that a router becomes an essential tool.

Price may have scared you away until recently. But that shouldn't stop you now. Rockwell and Stanley offer efficient new models for around $30 and $40.

This small investment gets you started. You'll want to add cutters and special accessories later. You can build as you gain proficiency in using the tool.

Perhaps you've always longed for a shaper. If so, you should consider that a router is an economical substitute. You should also note that acquiring a router and accessories can be cheaper than

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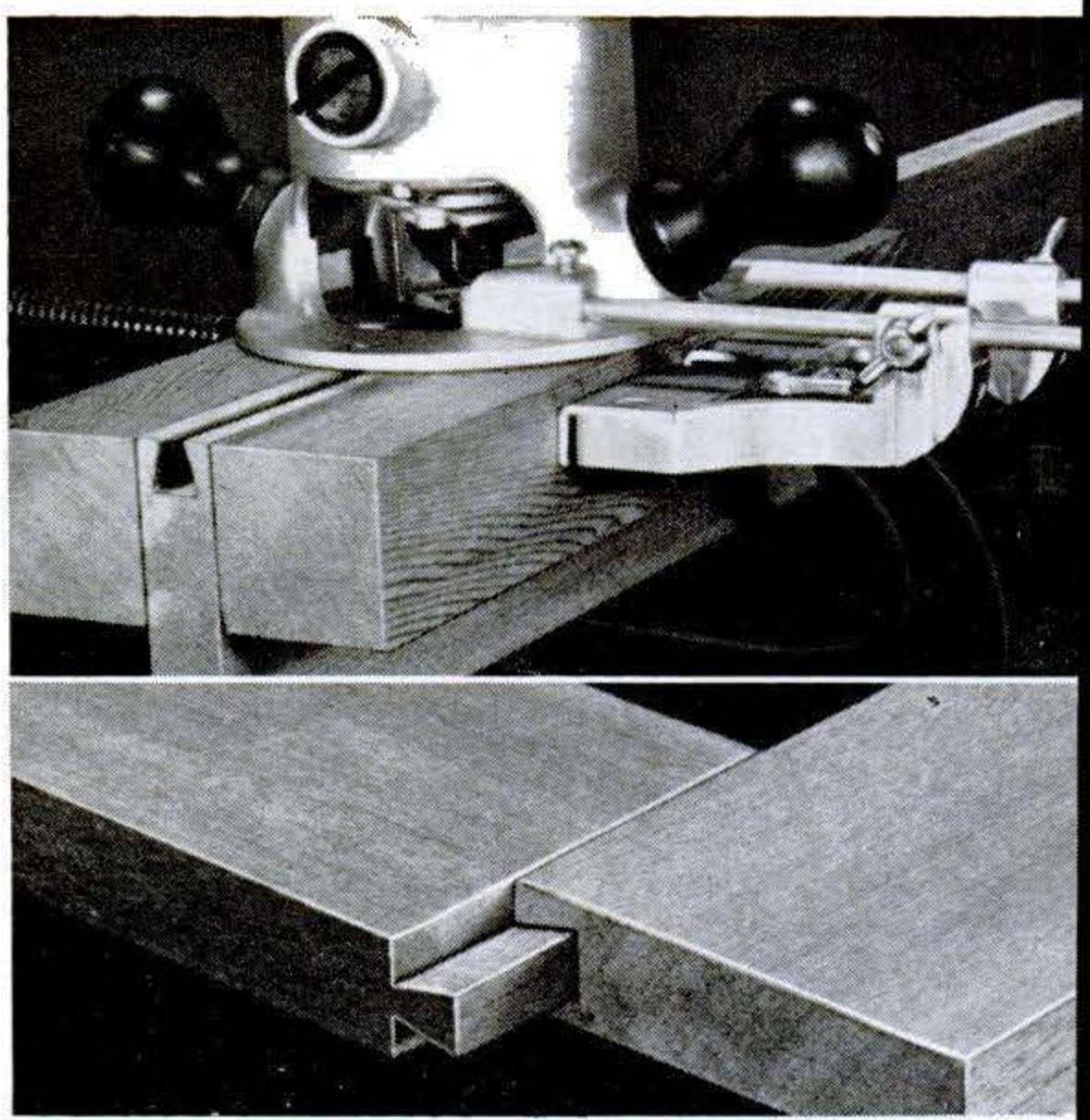

3 **Edge dovetailing** becomes an easy trick—even on simple frames. To cut the slot on a narrow edge you clamp support boards on each side of the work and position the router with the edge guide. Dovetail finger is done same way; needs two passes.

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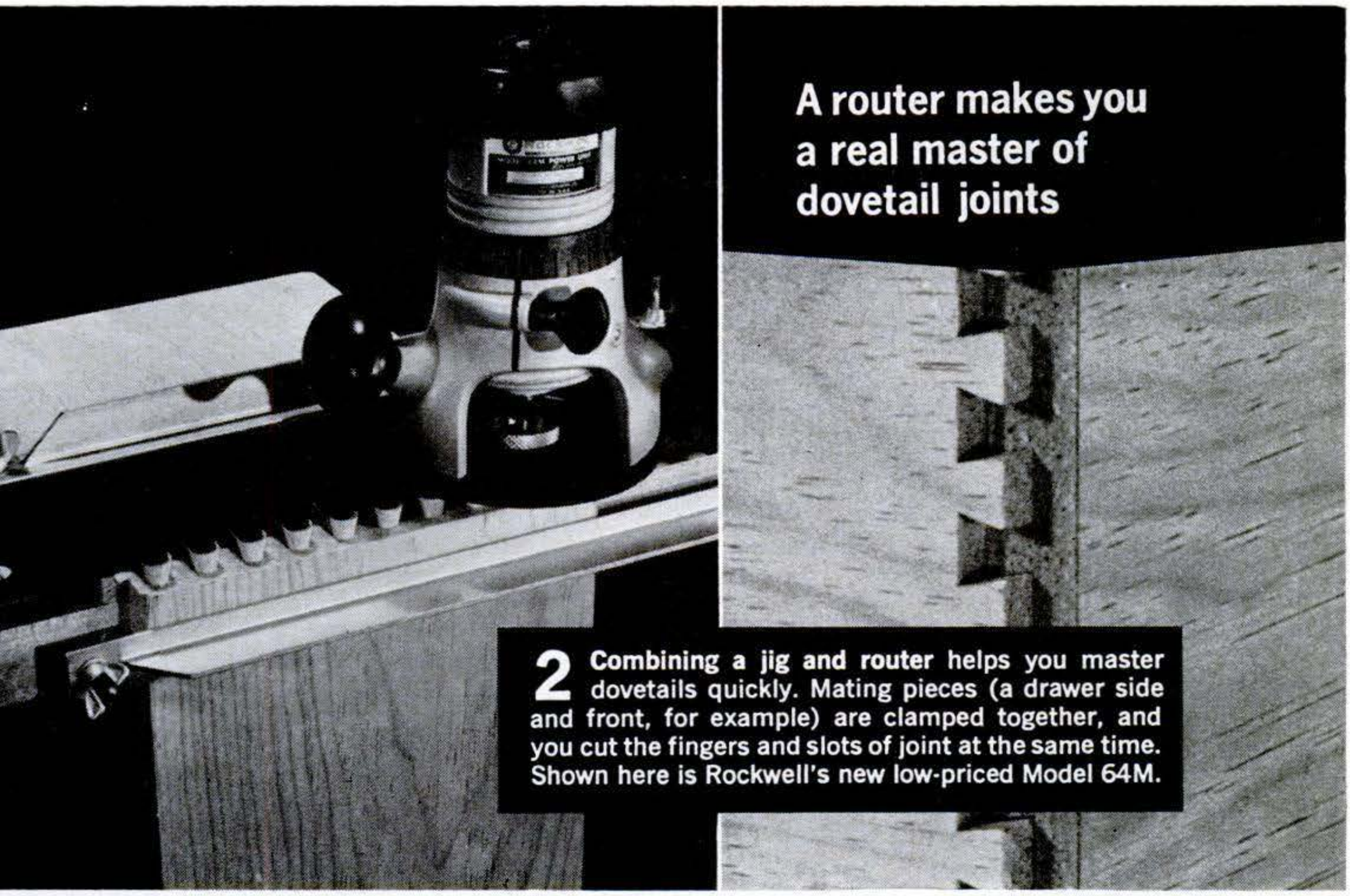
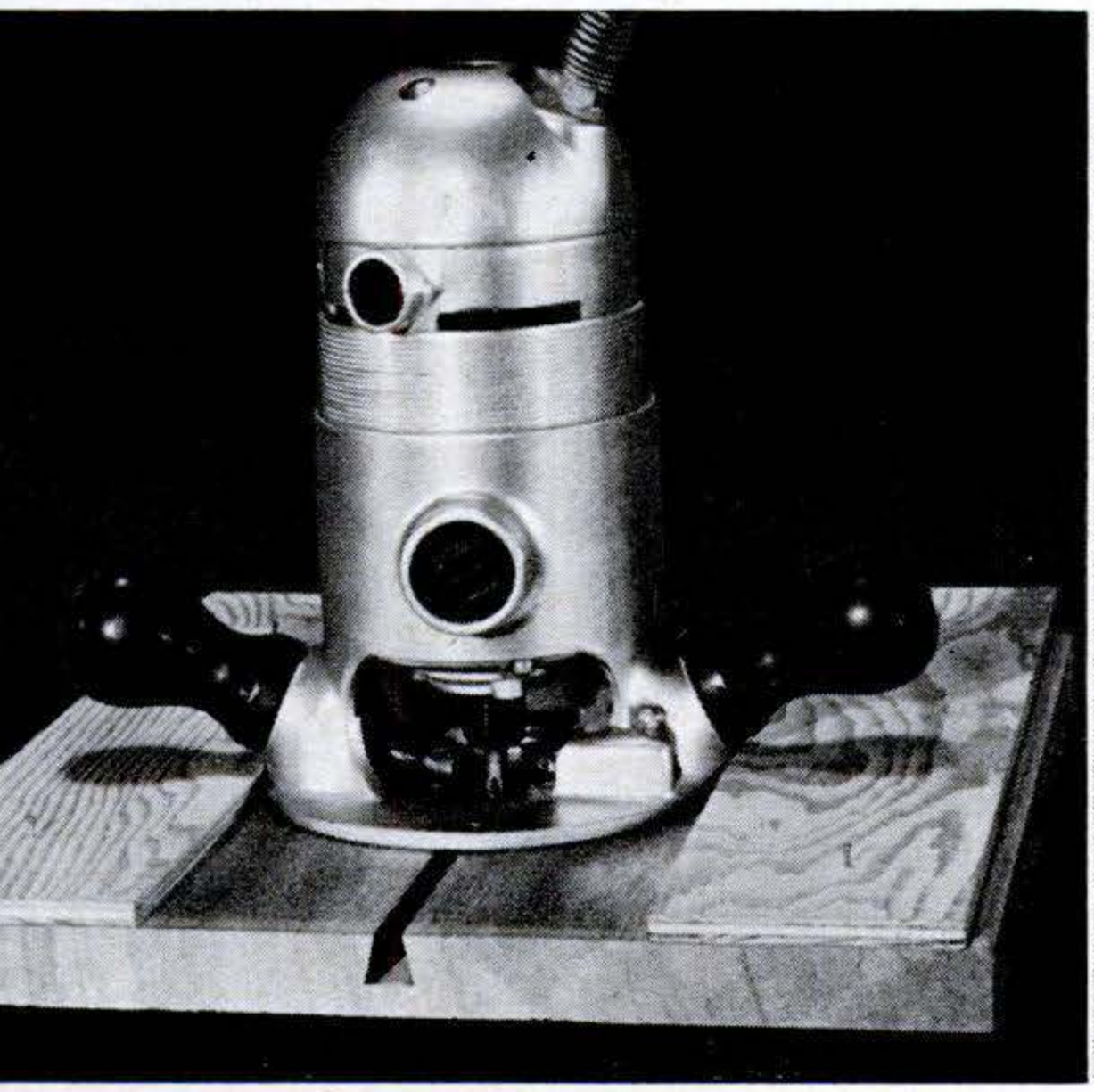


A router makes you a real master of dovetail joints

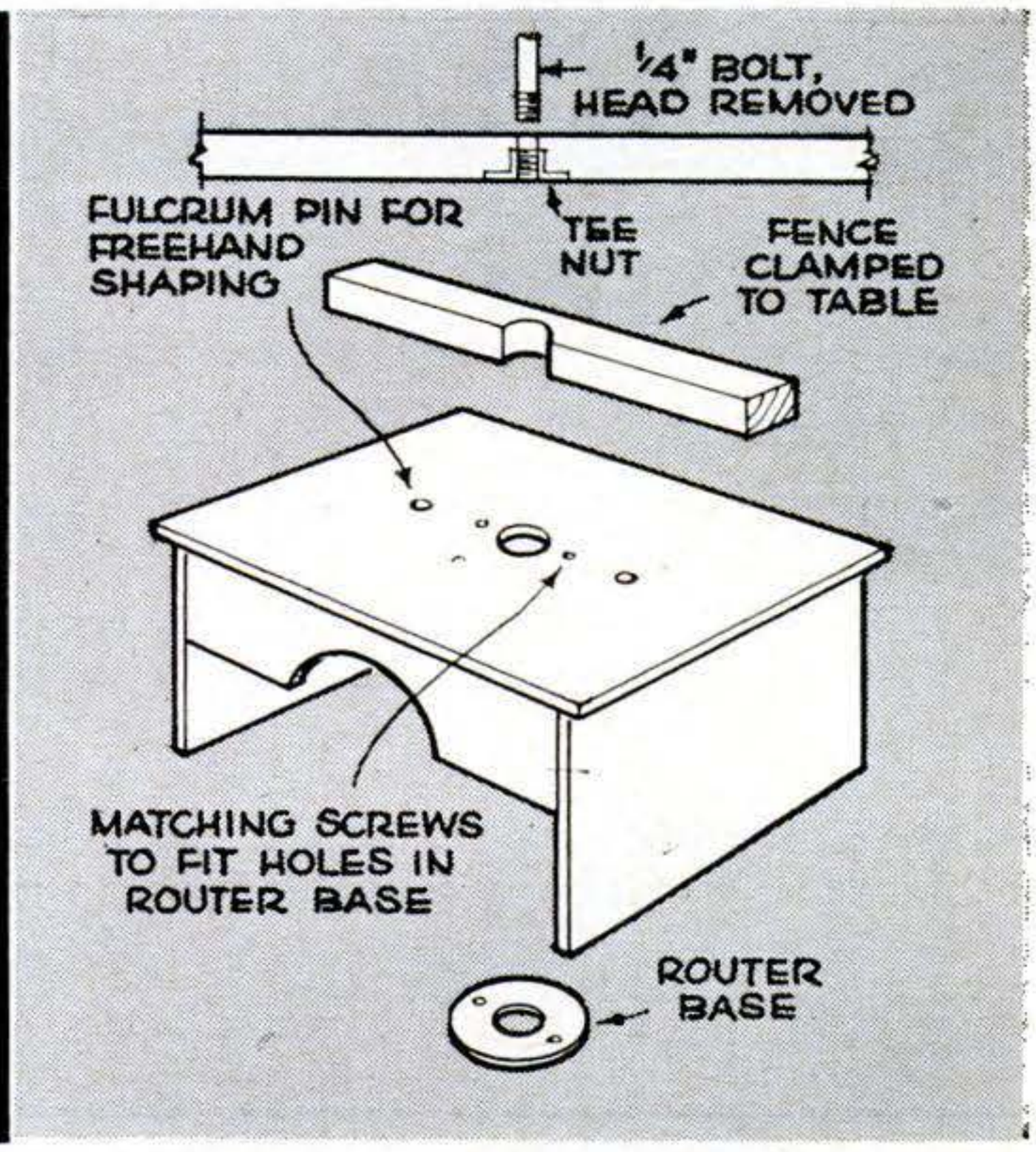
2 **Combining a jig and router** helps you master dovetails quickly. Mating pieces (a drawer side and front, for example) are clamped together, and you cut the fingers and slots of joint at the same time. Shown here is Rockwell's new low-priced Model 64M.

a Router

By R. J. De CRISTOFORO



4 **Dovetail slot** in a broad surface calls for two guides. One might do the job, but two insure that the router will remain on line. Tack or clamp the guides. This router is a Stanley that the author has had for some years. It's still going strong.



5 **Advantages of stationary shaper** can be had if you make a simple table like this one. With the router locked in place and the fence strip in position, you move the work past the router cutter instead of doing it the other way around.

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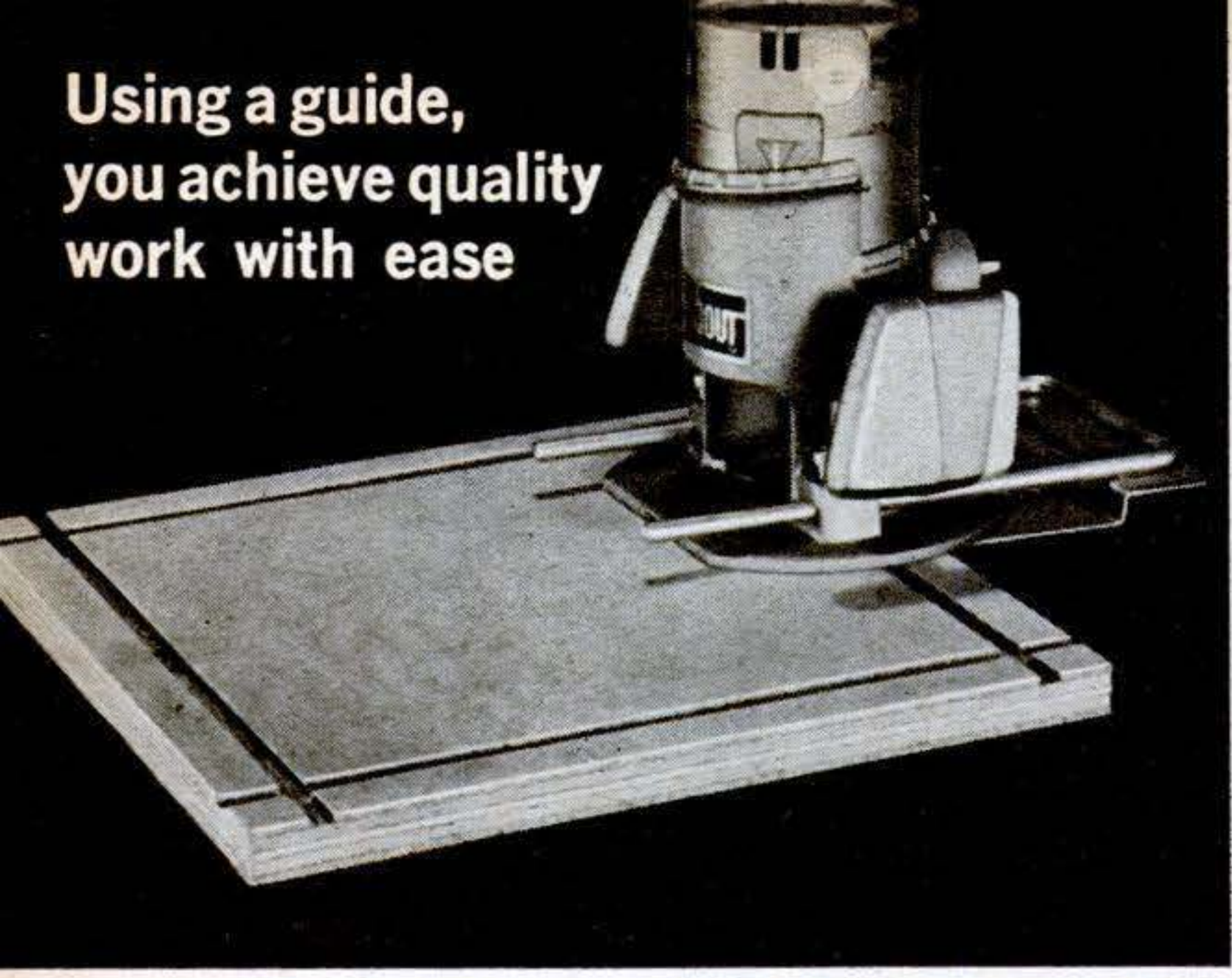
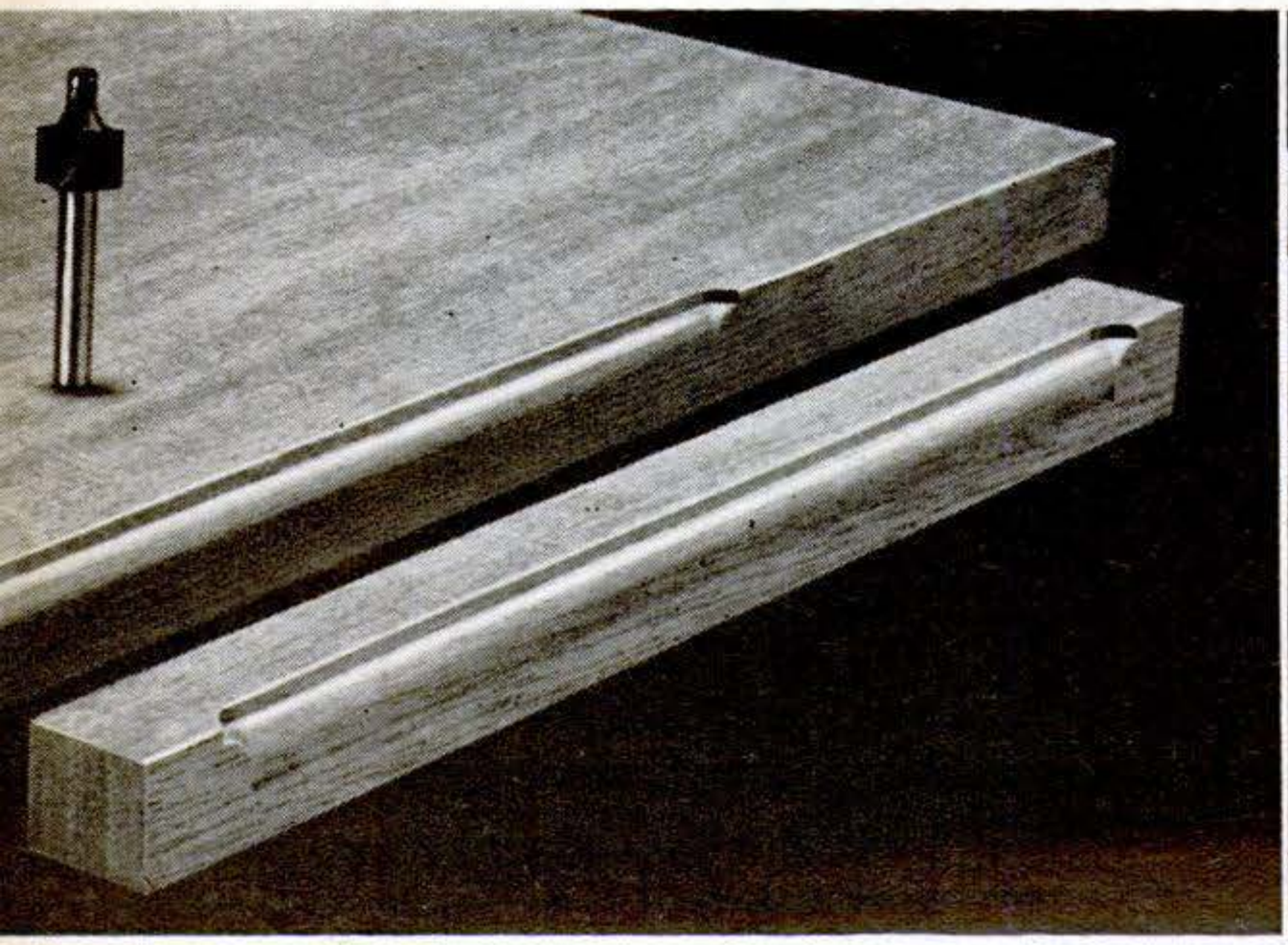
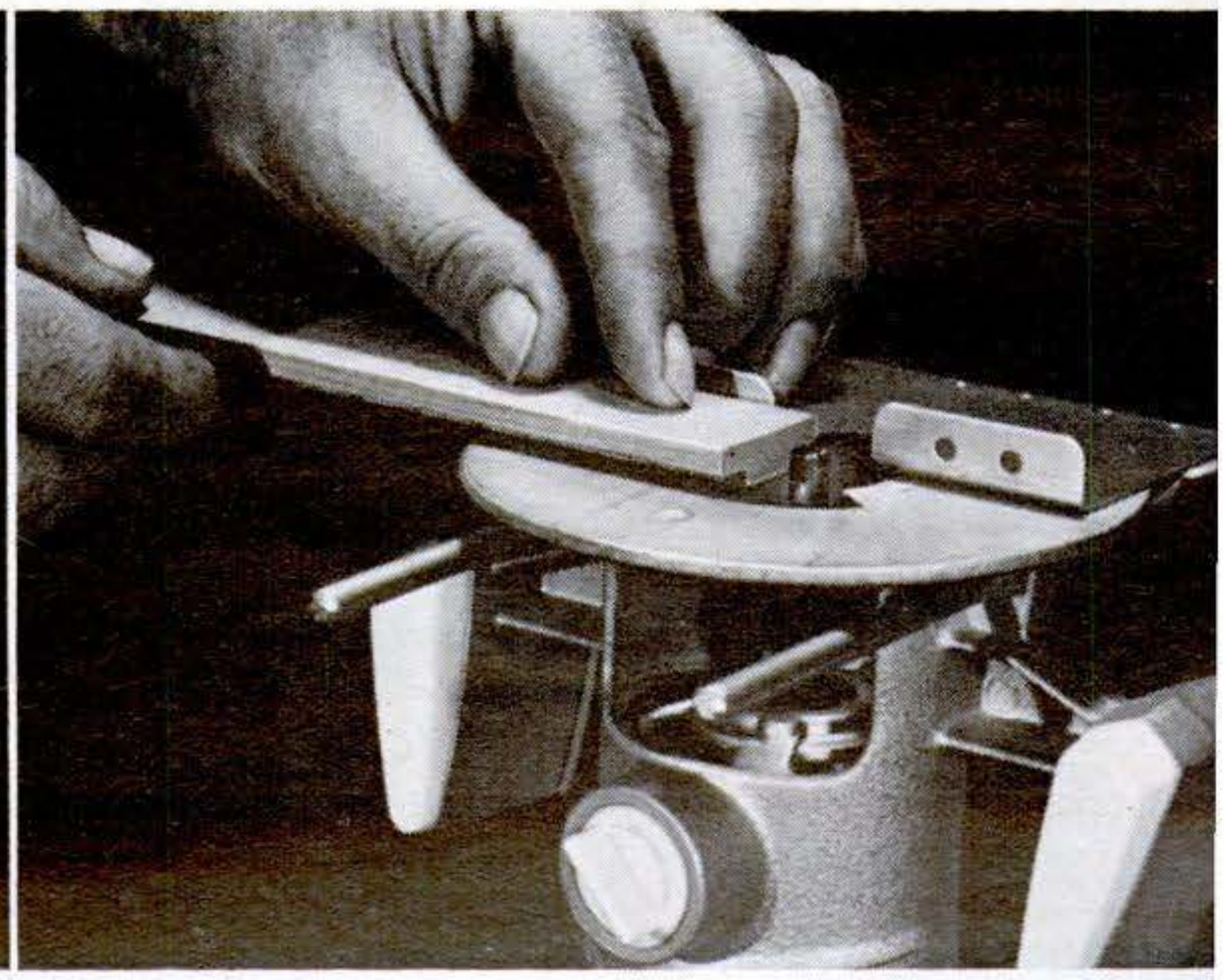


6 **For grooves parallel to edges,** use the edge guide, an accessory that is sometimes supplied with tool. Rout-About weighs a bit more than three pounds, has a ¼-hp. motor, turns at 25,000 r.p.m.

7 **Guide strips** can be used for straight cuts. When a cut is wider than the cutting tool, make repeat passes. This 1½-hp. model will cut deeper and wider (in one pass) than lower-priced models.



10 **A "pilot,"** which rides the edge of the work and so controls the cut, is found on many cutters, as here. For a cut on four edges, make cross-grain passes first, finish with with-the-grain passes.



11 **On very small work,** using the edge guide and clamping the router in an upside-down position gives you a "shaper." Use left hand to guide and hold work—don't let it pass over cutter.

equipping a drill press for shaper and router activities.

What will they do? You can often use a router in place of a molding head, a shaper, a drill or drill press, even a jigsaw (a router can be used to do some pretty intricate piercing).

You can cut grooves and dadoes, form rabbets and lap joints. You can shape tongue-and-groove, mortise-tenon, and dovetail joints. You can do cutouts and piercing, carve recessed or raised designs, shape edges, facet surfaces, make your own moldings, trim plastic counter-top edges, do fluting and reeding.

How to use them. Most times, a light touch is best. A router turns at a speed as high as 28,000 r.p.m. The speed is there to give you a burnished cut (smoother than you can get with sandpaper), not to prompt you to rush. This is especially true of the low-priced units since they don't have the power of some larger ones—which can put out as much as 1½ hp. This is not a big drawback for anything the home craftsman will tackle; it means that on some work you may have to accomplish the cut with repeat passes instead of in one.

But regardless of power or depth of cut, no router should be forced. Doing so will result in inaccuracies, burned wood,

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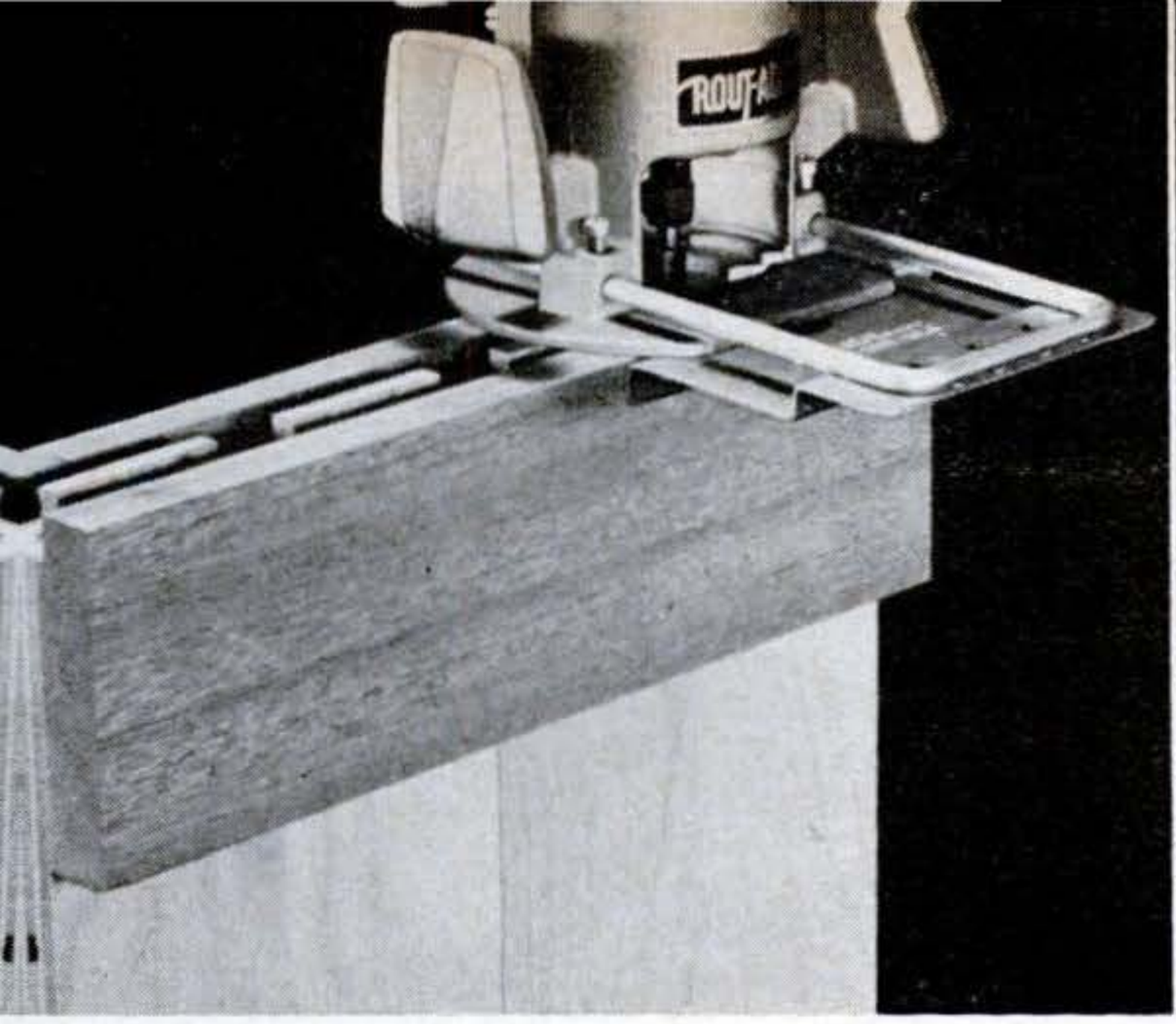
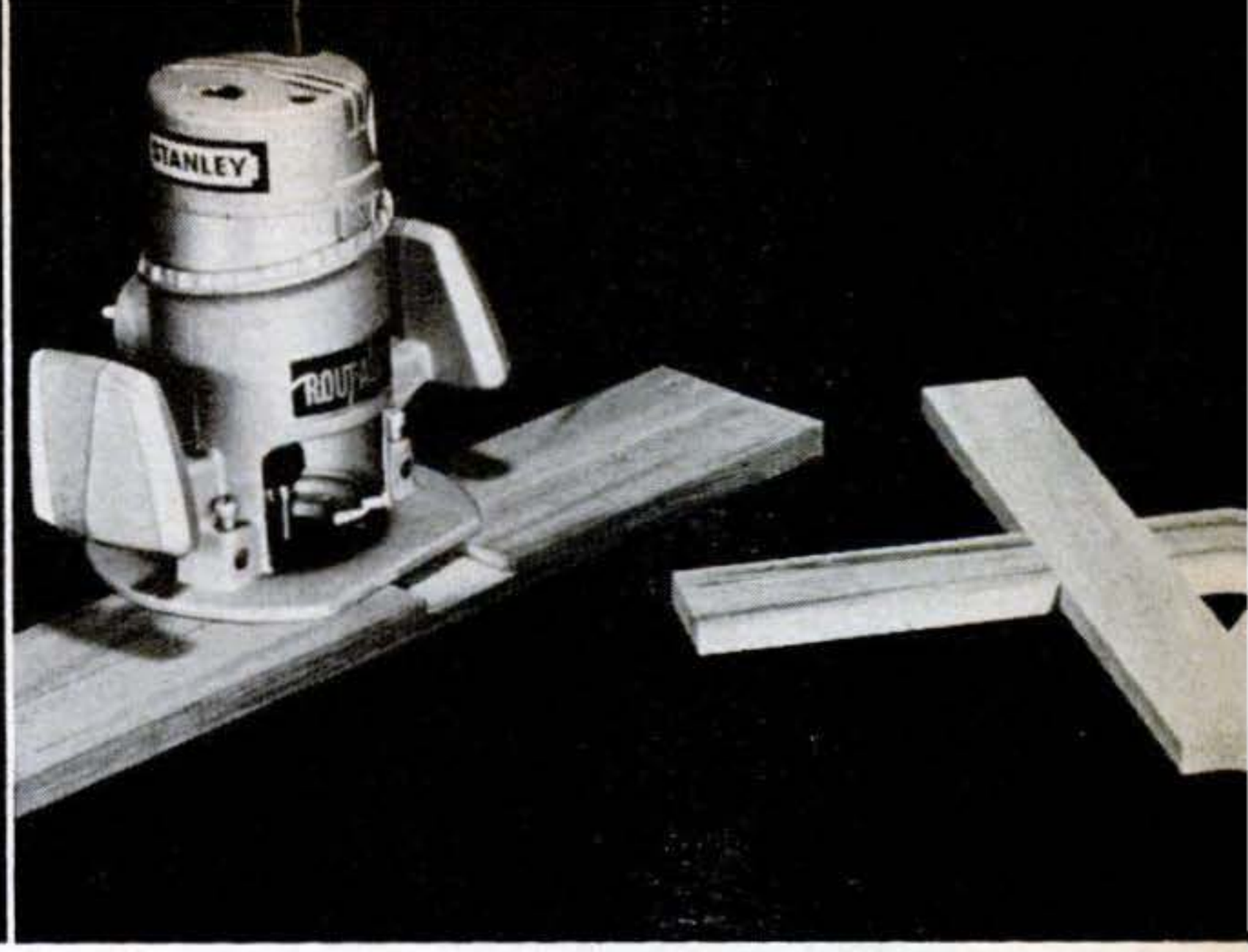
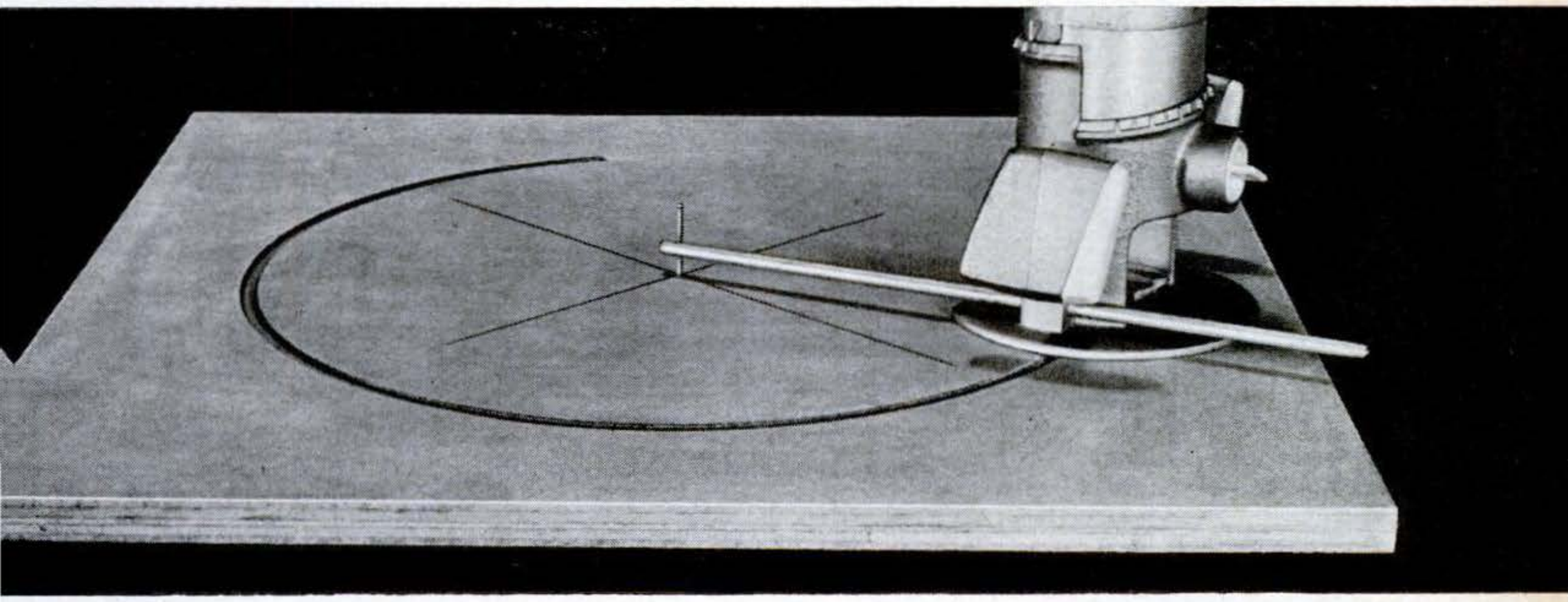




8 **Tenons are cut** by using support boards on each side of the stock. For wide cheek cuts (being done here) pieces are ganged edge to edge. For narrow cheek cuts, gang surface to surface.

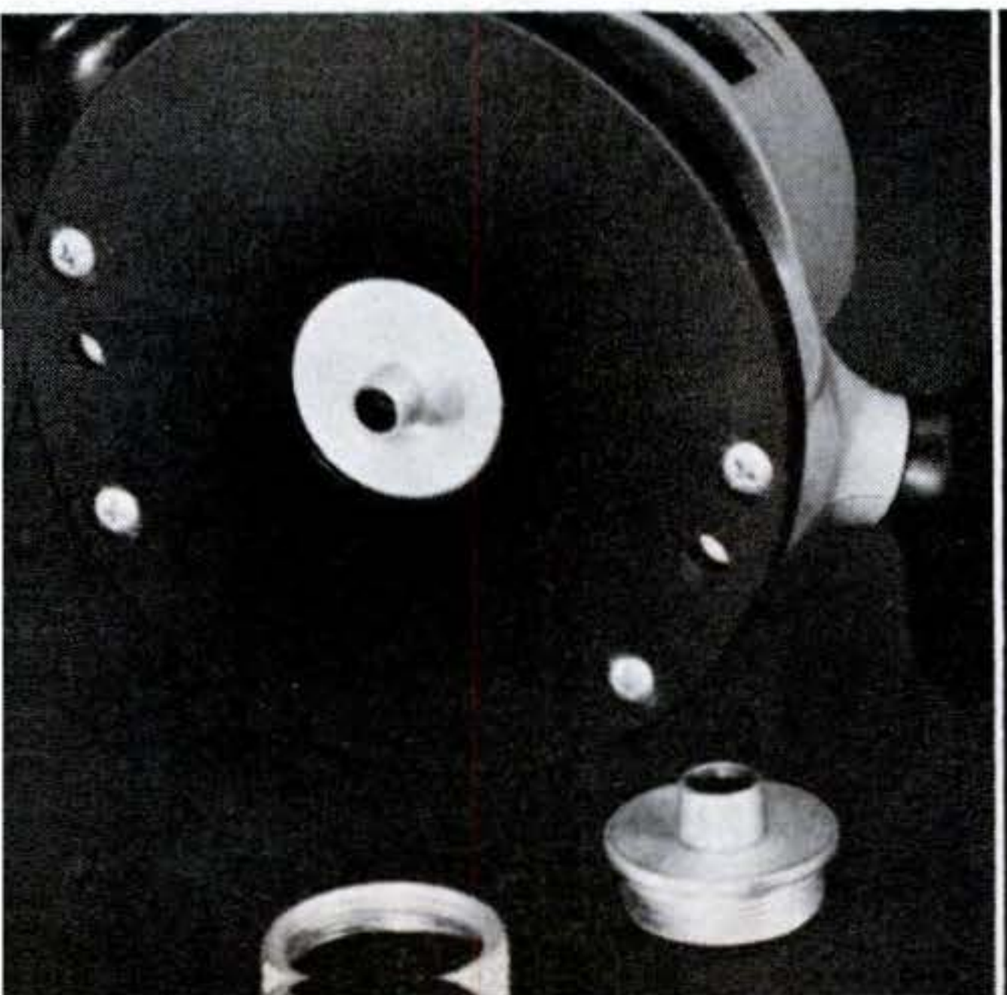
9 **For lap joints,** gang as many pieces as you need. Make the cut as wide as the width of the stock and half as deep as its thickness. Best bet is to use guides for outline. Clean waste freehand.

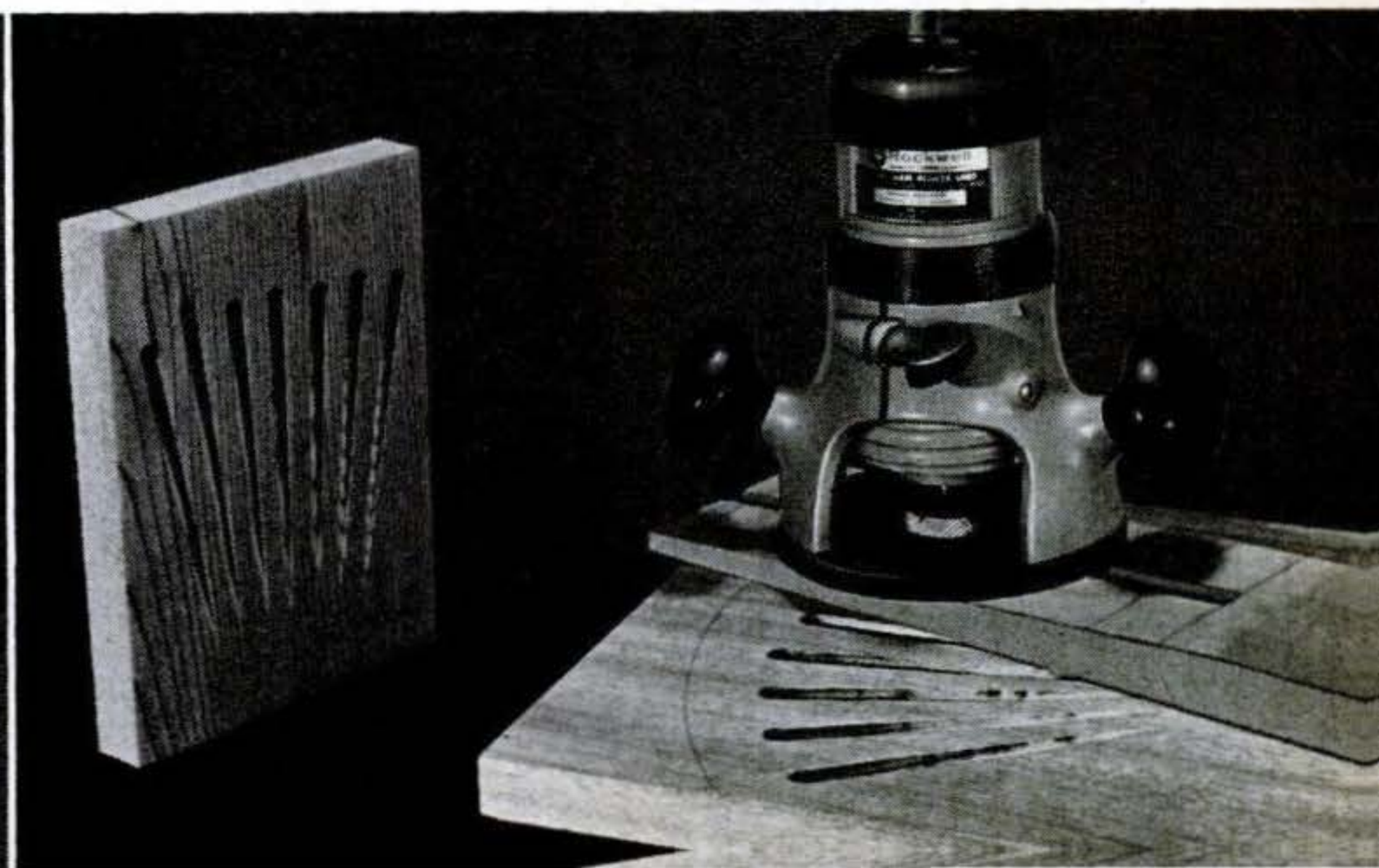


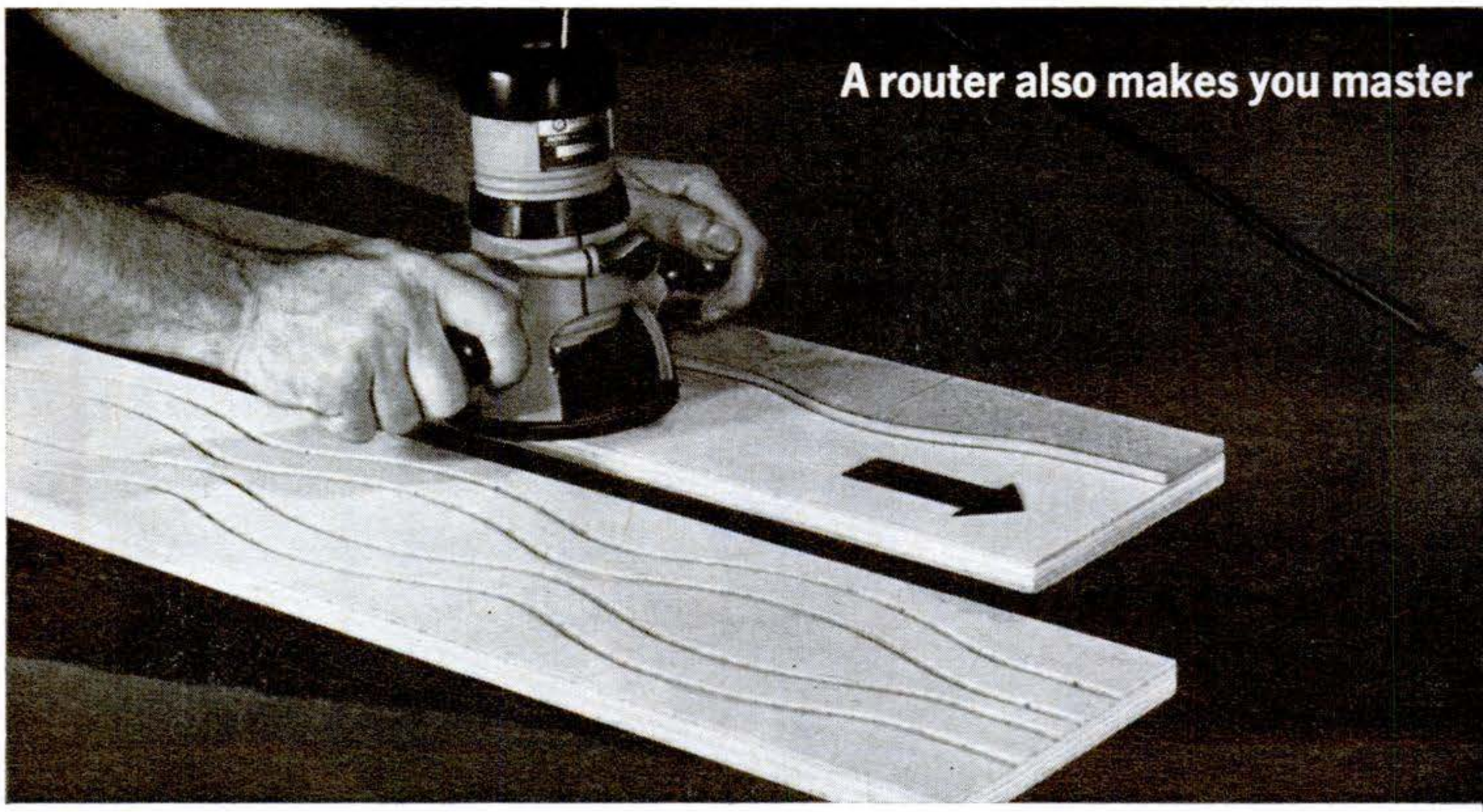
12 **You can cut circles** of any size. By using a piece of ¼" drill rod or dowel in one of the holes designed to take the edge guide, you have an easy-to-use pivot jig—as you see in this photo. You can simply cut grooves in the wood or, by making repeat passes, you can cut right through it, ending up with a perfect disk. Note that the pivot is a nail through a hole in the rod or dowel.

13 **Template guides** are important accessories. They lock in the router base and provide a sleeve to ride the edge of a template. This way, you cut less than 1/16" away from edge of pattern.

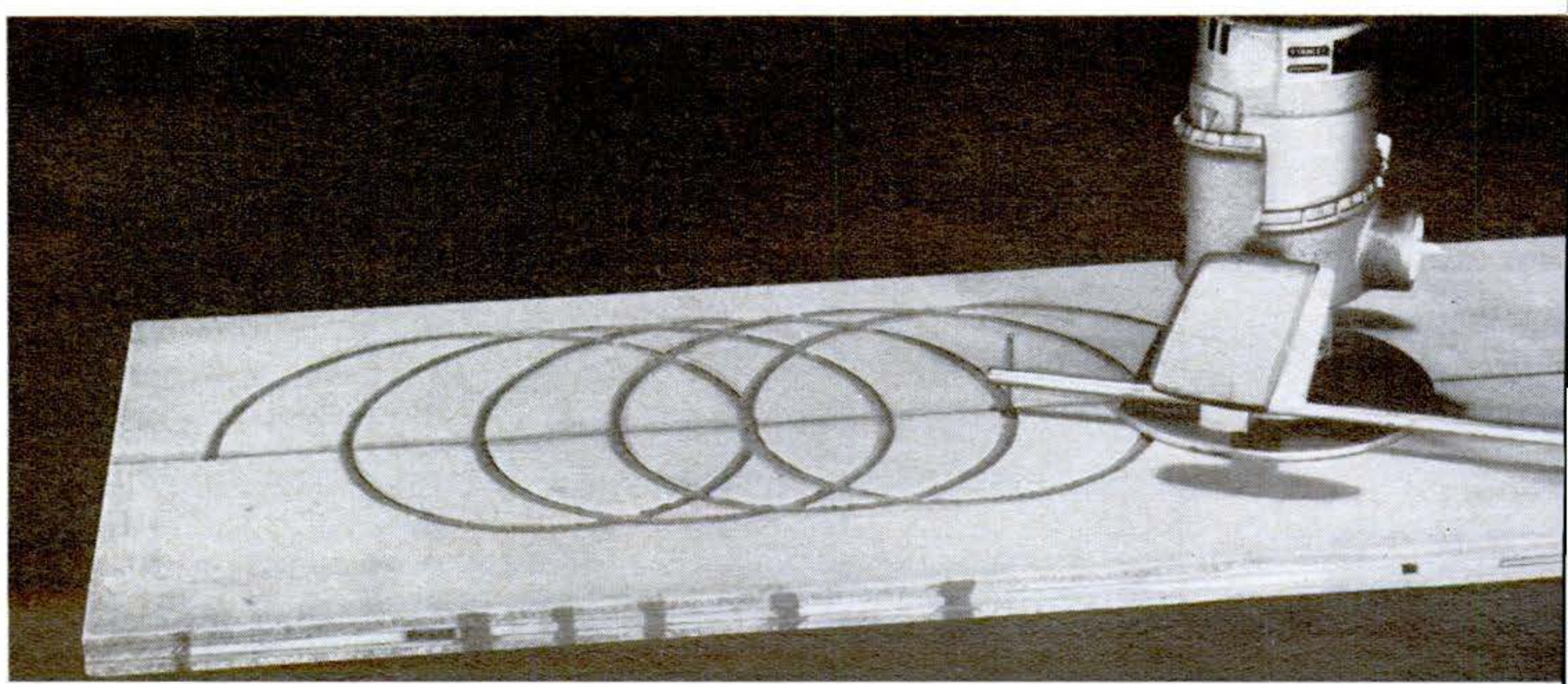
14 **For tapered fluting,** just use a tapered guide block for the router to ride on. For a circular or half-circle design of this kind, use a nail through the block to serve as a simple central pivot.



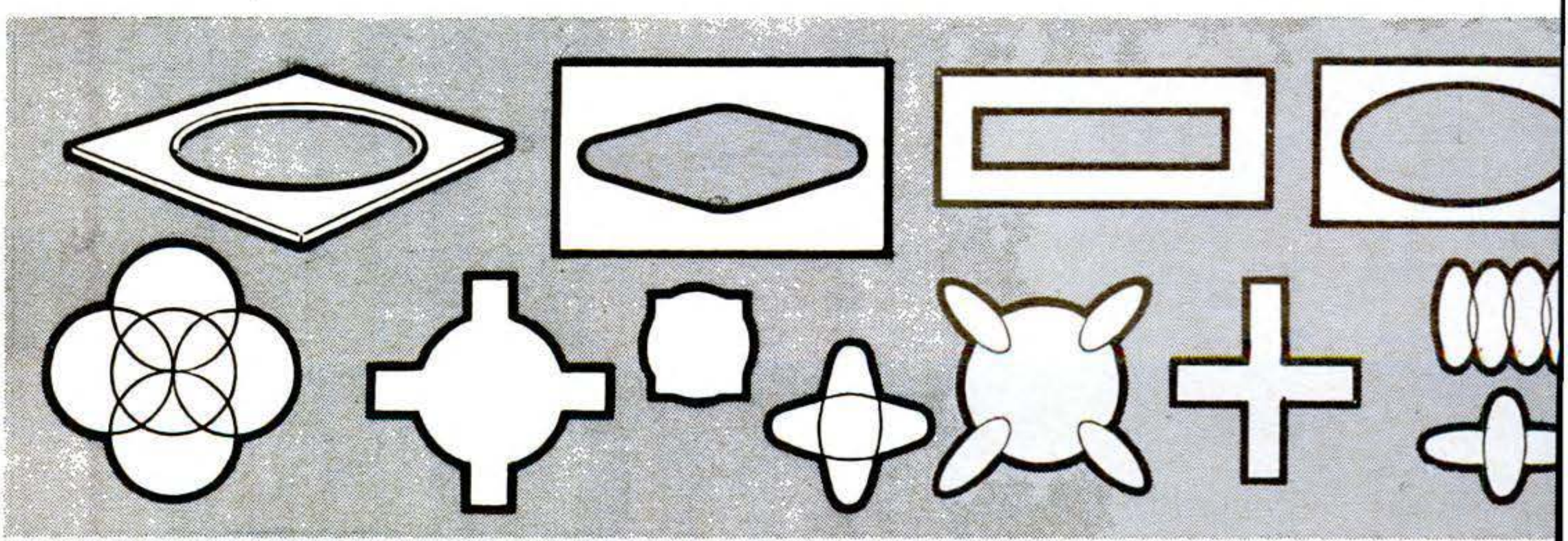




15 **Templates,** which are followed by the edge of the router base, can be made. Design in foreground was made by relocating template after each pass. This is Rockwell's new ½-hp. router.



17 **If you want to get "eccentric,"** change the radius of alternate circles or half-circles. Accuracy in lining up the cuts is very important for this—but it's just a matter of working carefully.



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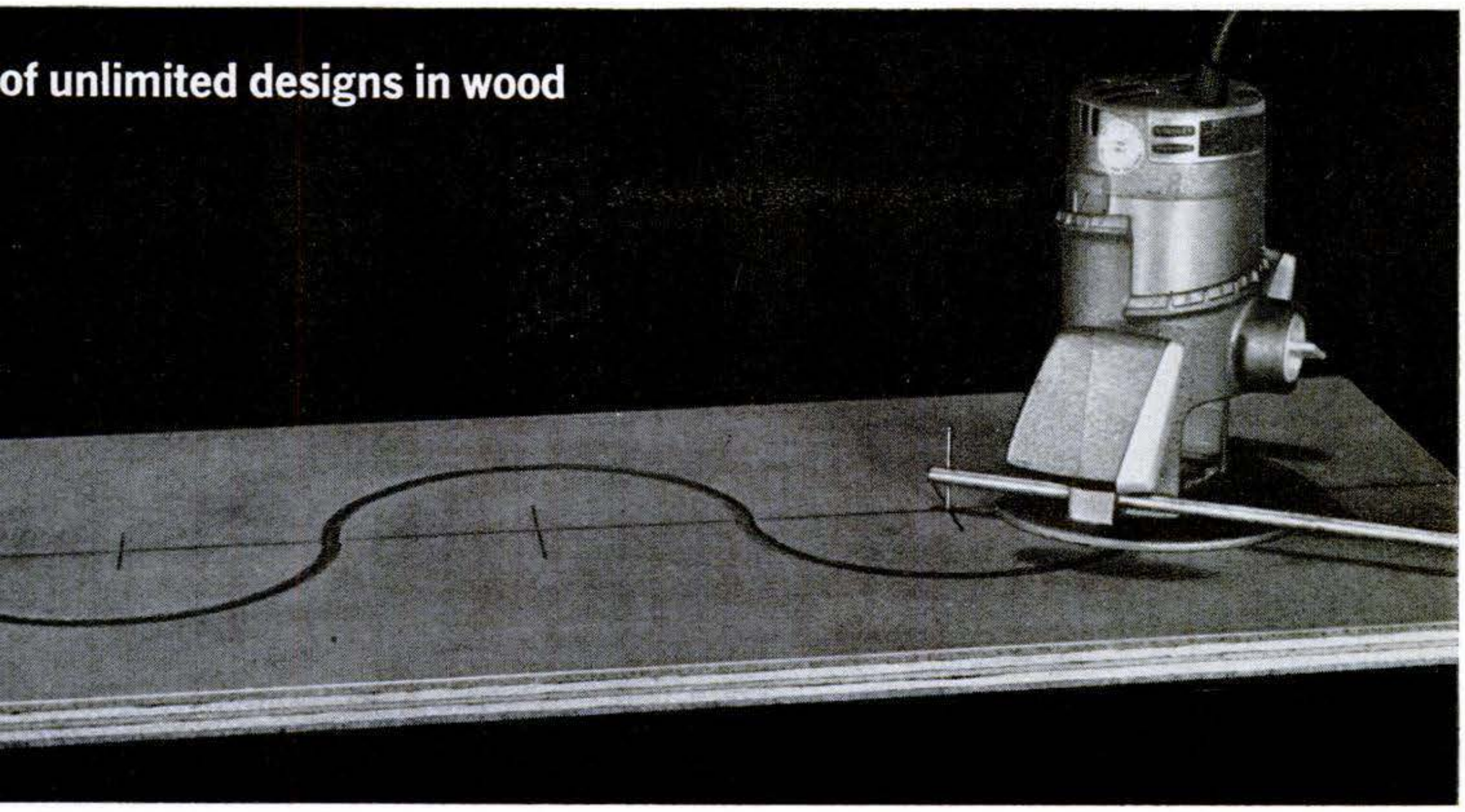
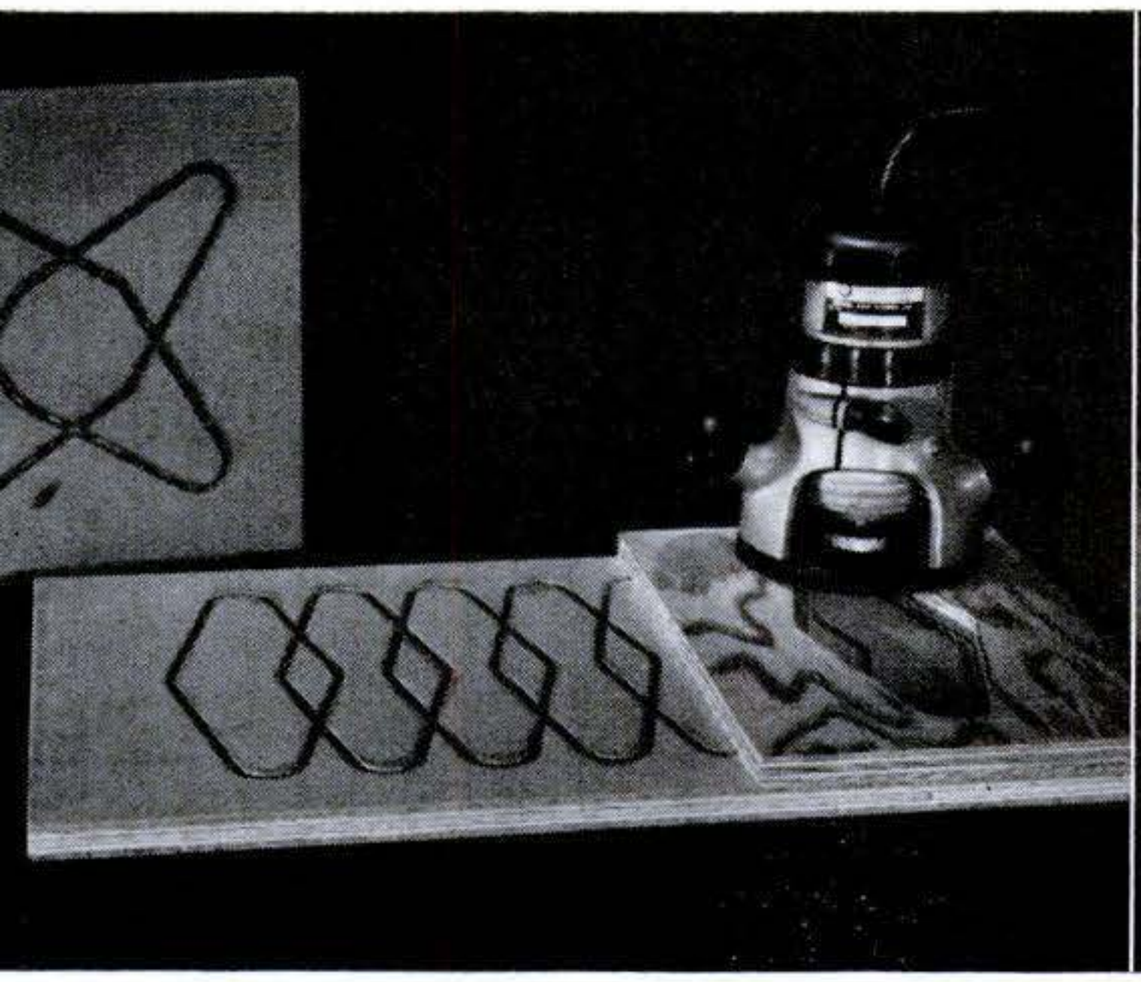
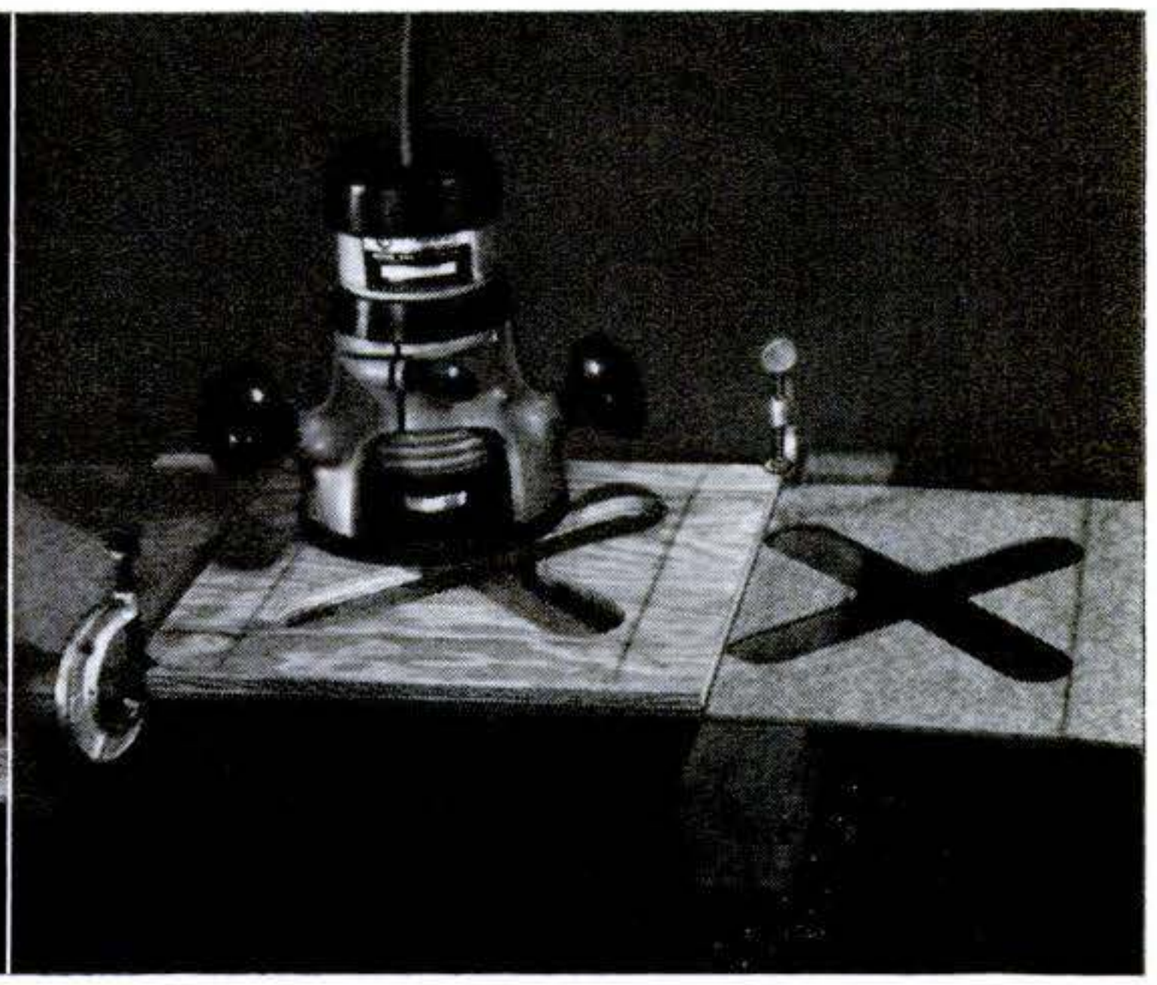


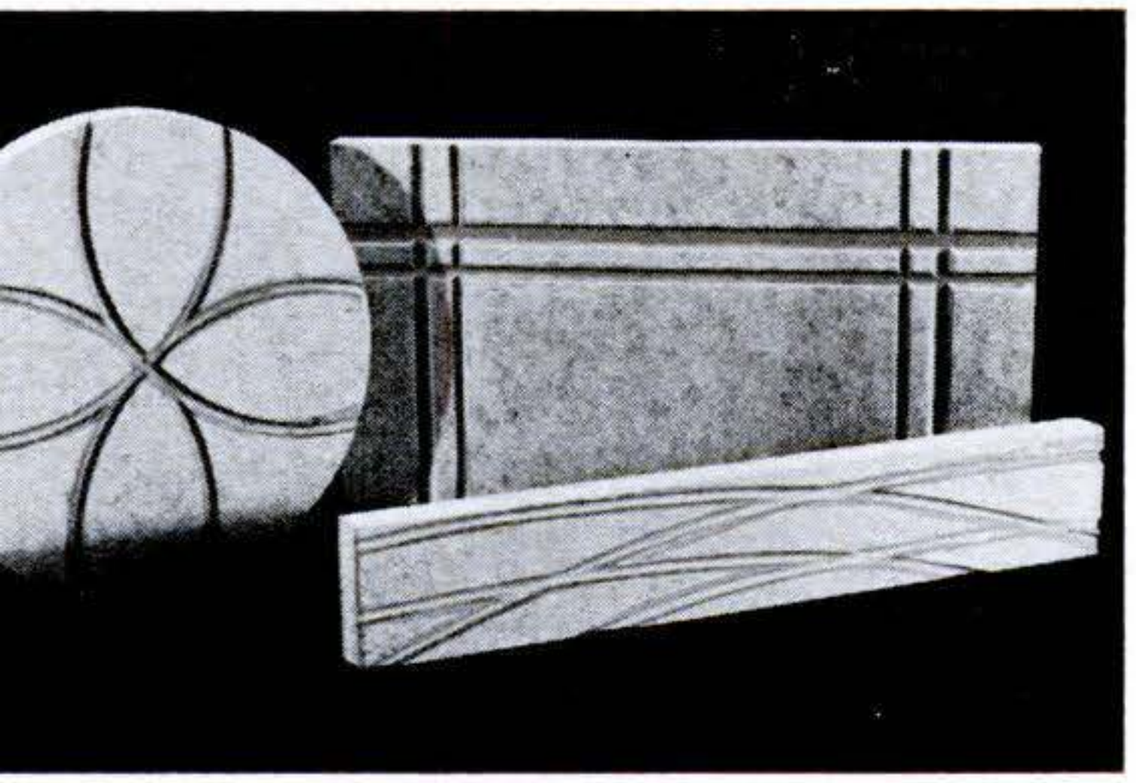
16 **To form uniform reverse curves,** locate pivot point after each half-circle. Keep the router bit in the end of the cut already formed and tap down the pivot pin in its new location.



18 **Relocate a template** after each pass for many interesting designs. See drawings on facing page for other ideas. Template thickness must be a bit greater than sleeve projection.



19 **For piercing,** which can be a lot more intricate than in the example shown here, you work with a template and a template guide. On thick stock you have to make repeated passes.



burned cutting tools, and disappointment. On softwoods you can move faster than on hardwoods, also on shallow cuts as opposed to deep ones—but the best guide in all situations is your own feel of the tool. If you are ever in doubt about how the tool will react to the kind of wood or depth of cut, test it first on scrap. PS

Intersecting lines, arcs and circles, irregular curves, or combinations of them lead to unlimited interesting design possibilities—as you see in these samples at left.

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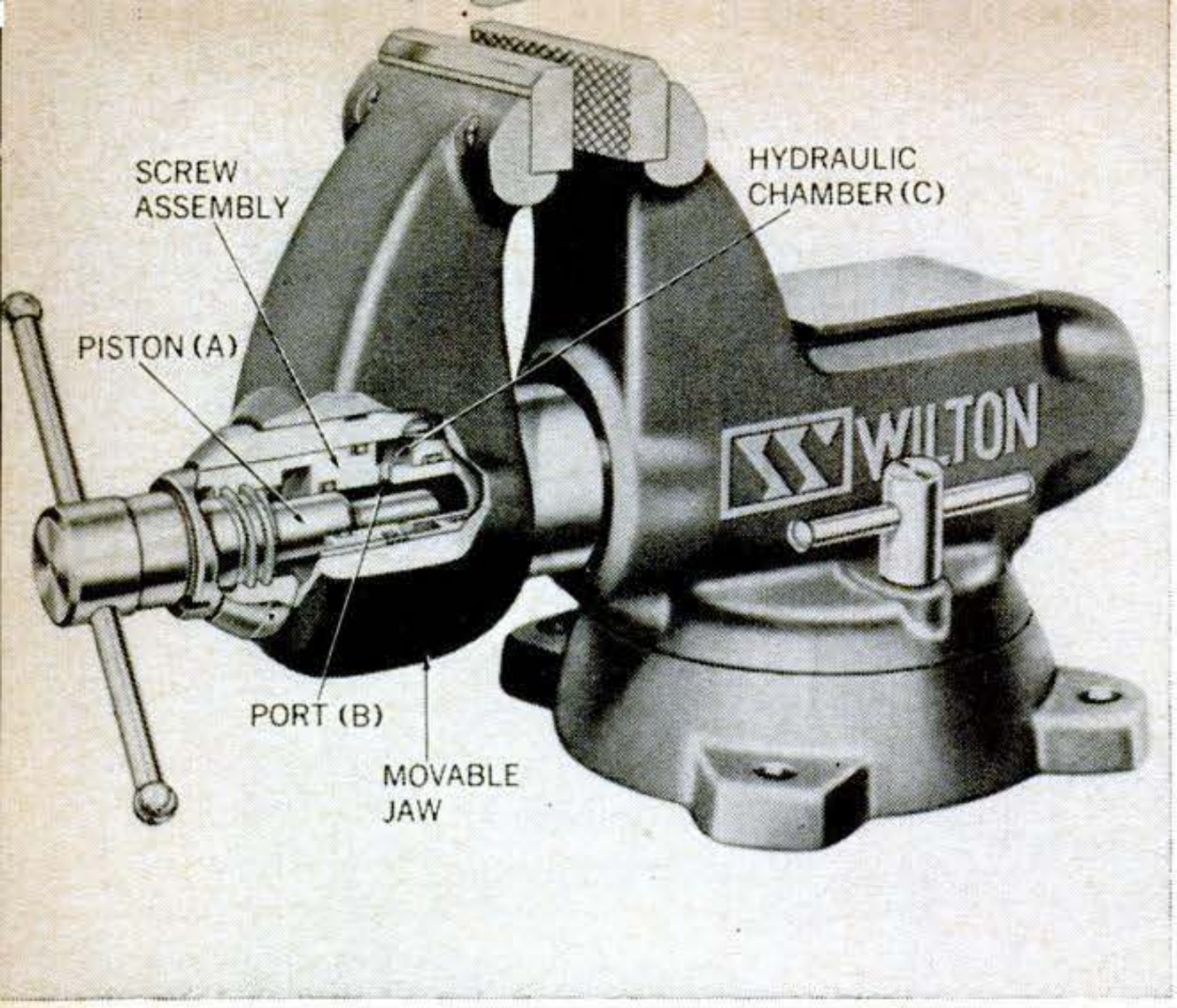
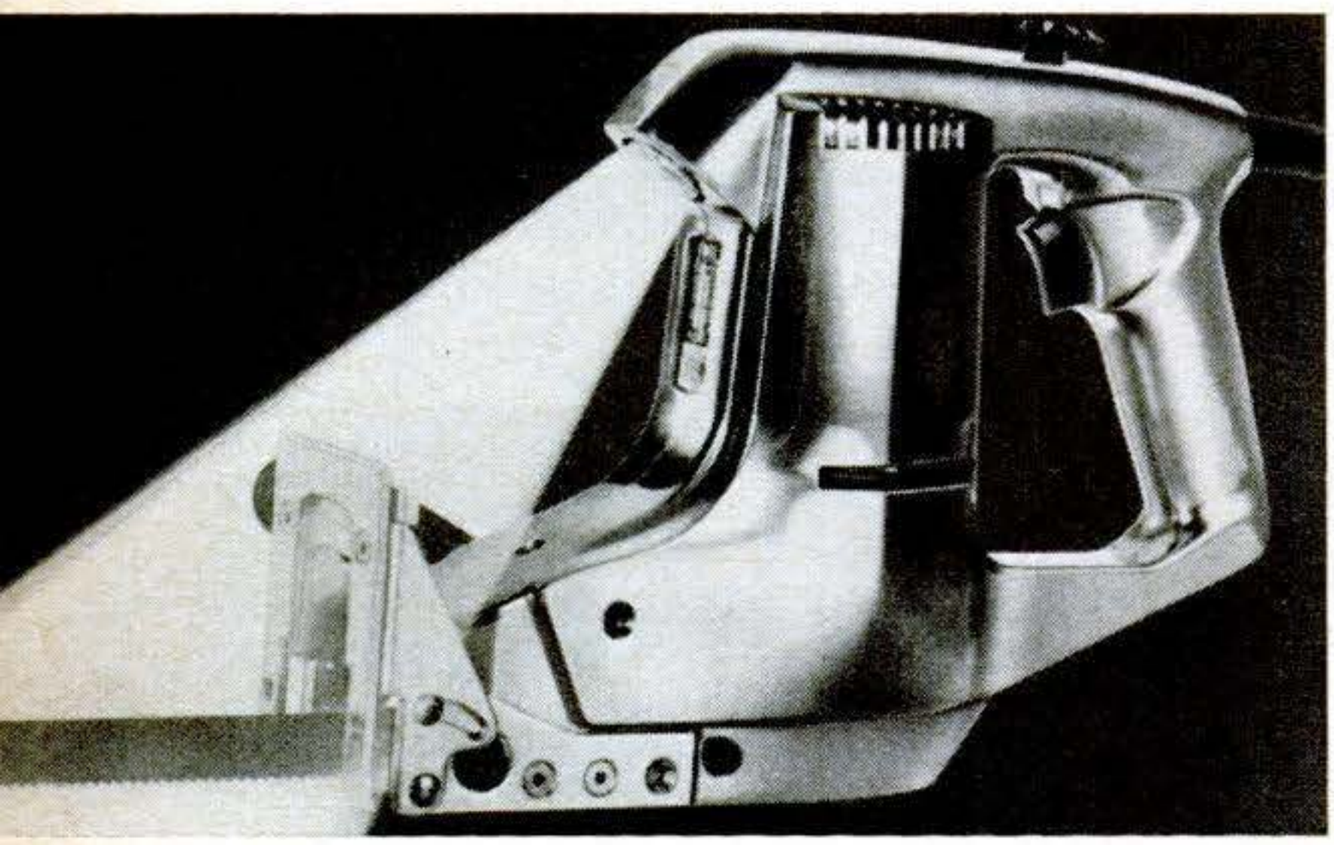


What's New in Tools

Vise offers exceptional holding power

Here's a machinist's vise that clamps and holds workpieces with up to three tons of force. Because of a built-in hydraulic piston and reservoir system, no buttons, cams, hoses, or switches are necessary. A PowRscrew assist is engaged when you turn the handle and the jaws come in contact with the work. As you continue turning, the piston (A) advances, forcing oil through the port (B), and into the chamber (C), creating a 6,000-pound hydraulic pressure. Wilton Tool, Schiller Park, Ill., is the maker.

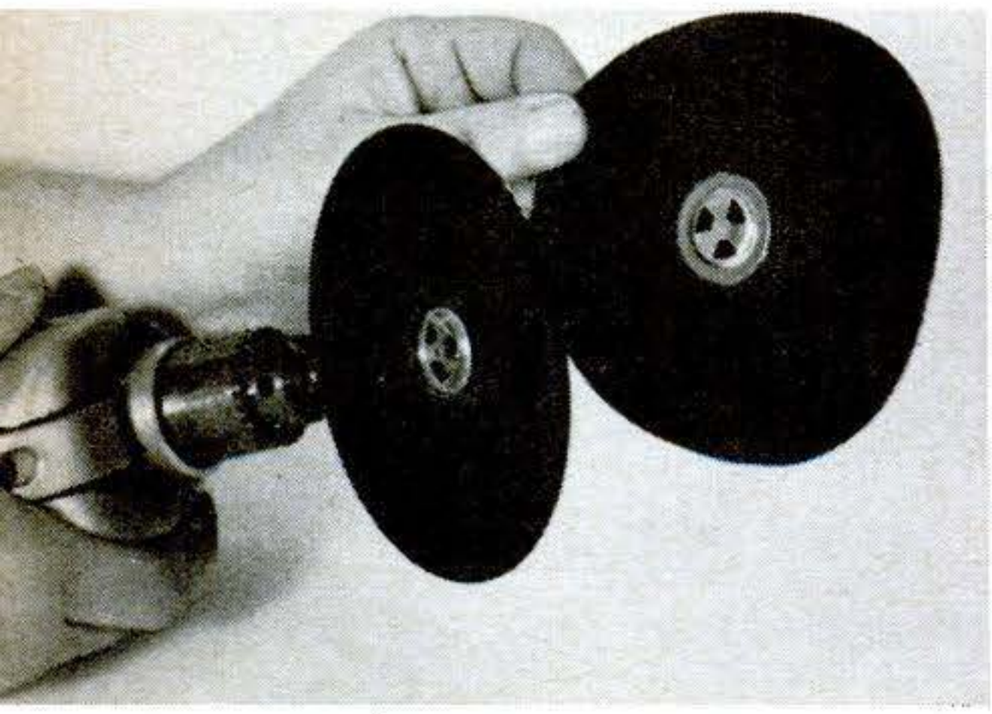


See what you saw with this one

A new Shopmate reciprocating saw lights up the cutting area and has a dial-adjusted operating speed ranging from 600 to 2,100 no-load strokes per minute. The saw makes its own starting hole, and the blade can be locked in six cutting positions.

Sanding disk has no center bolt

Because there's no metal, the CQR abrasive disk permits you to sand with the entire disk surface. A metal disk fused to the reverse side locks onto steel fingers on a holder pad. Grit sizes are available from 24 through 240. Pad, shank, and three disks, $4.95. Standard Abrasives, Inc., 19015 Parthenia St., Northridge, Calif. 91326.

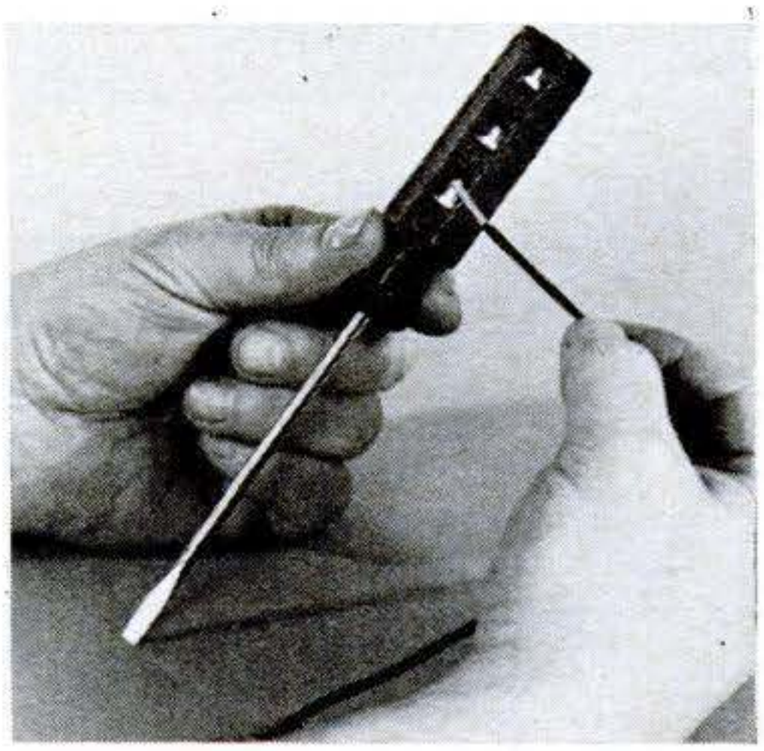


Easier-to-fill chalkline

The lightweight aluminum Chalkmaster has a pushbutton for instant line release and long-wearing nylon gears that give quicker rewind. It can be used as a plumb bob, too. A felt gasket makes it leakproof. Choose a 50′ or 100′ reel. About $3. The Stanley Works, 195 Lake St., New Britain, Conn. 16050.

Two-in-one tool saves space

This combination screwdriver-wirestripper enables you to carry fewer tools when doing electrical work. To strip wire, insert it in the right hole and pull slightly upward. There are four models ($1 to $1.49) with cutters to strip numbers 20 through 12 stranded or solid wire. Holub Industries, 413 DeKalb Ave., Sycamore, Ill.



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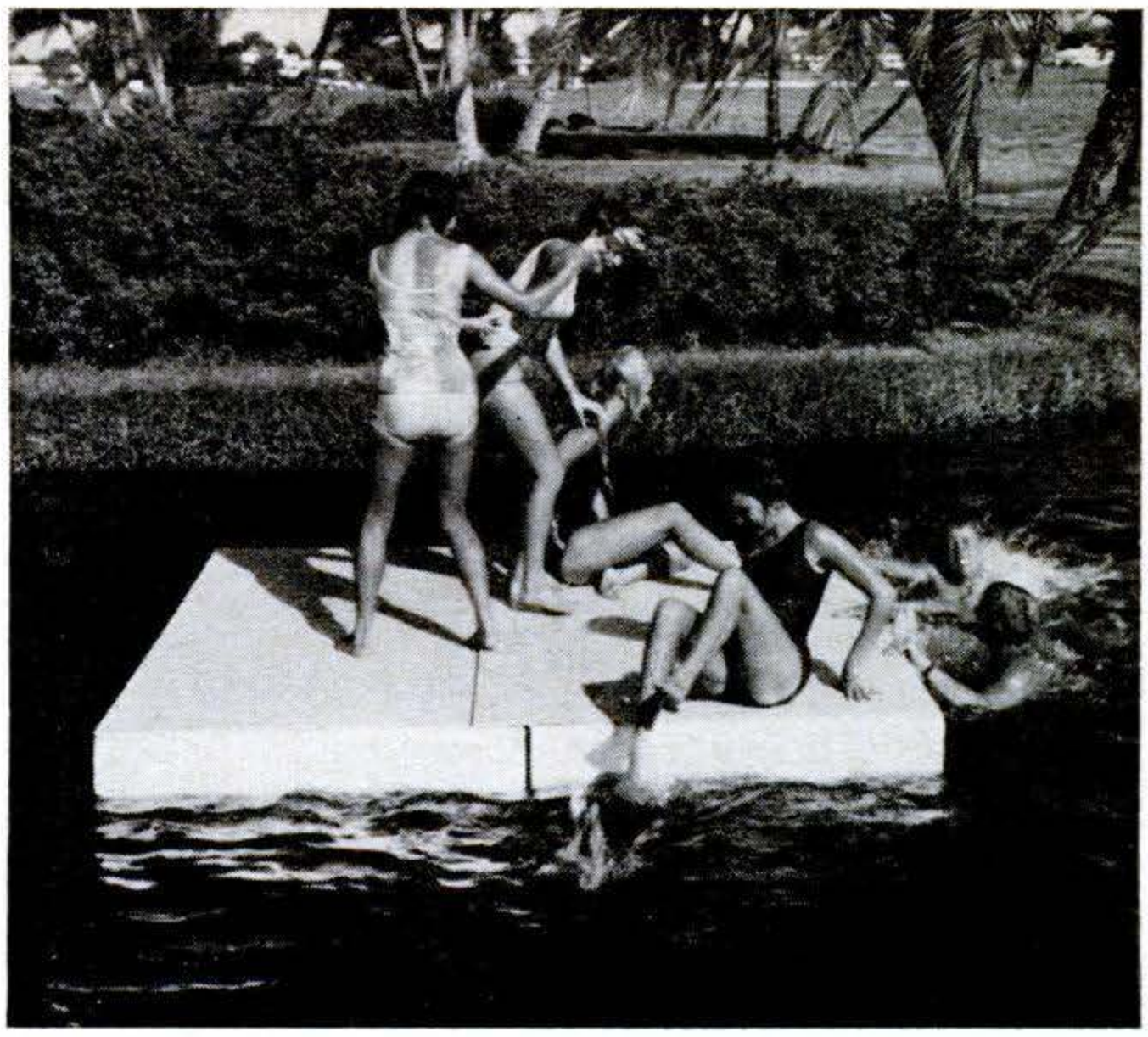
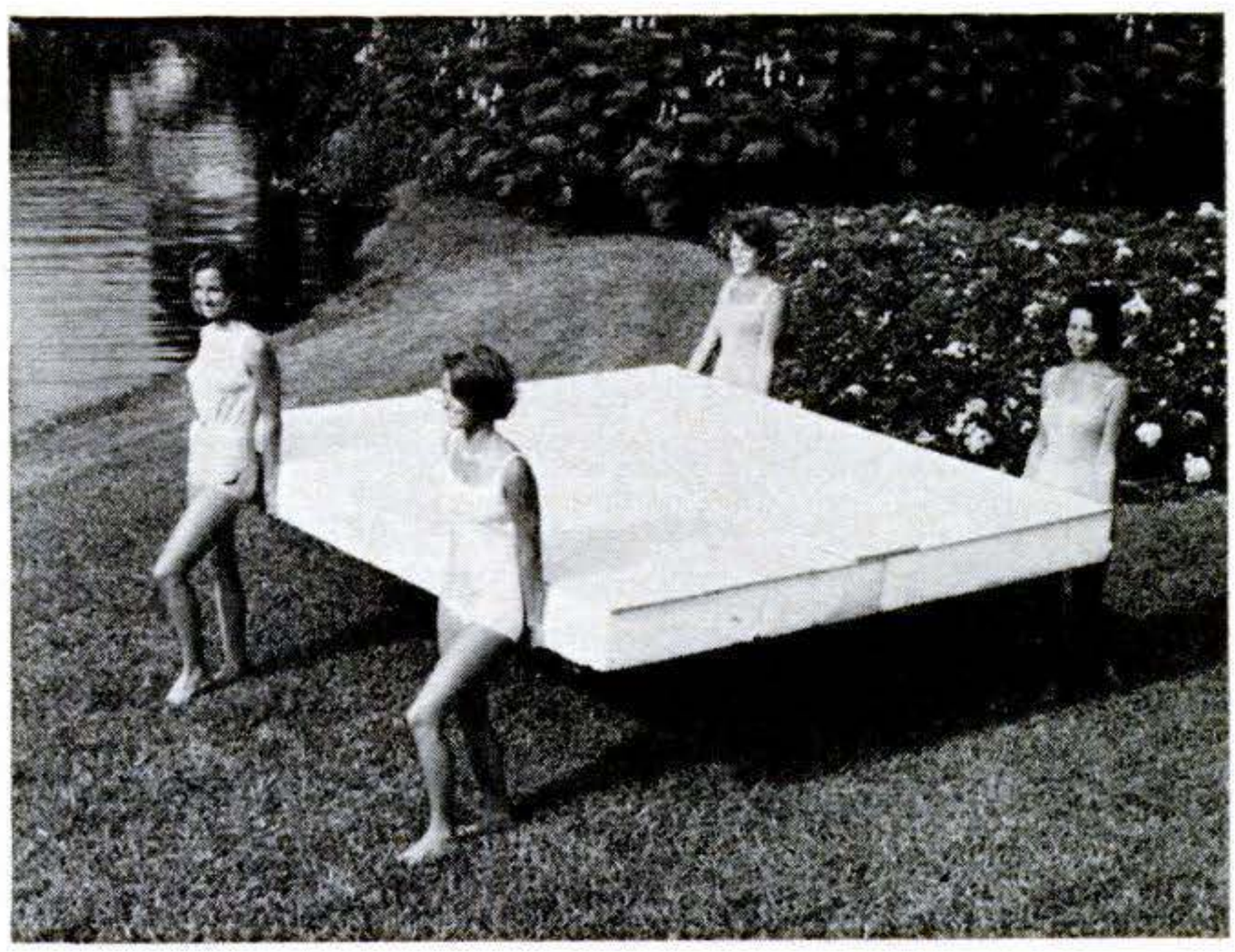
How to Build a Foam Raft Fast

Cheap, fast, and easy to build, this raft takes only an afternoon's work. The main elements are two 4′-by-8′-by-7½″ Dyfoam flotation billets, two 4′-by-8′-by-⅜″ sheets of exterior plywood, and three 8′ skids of two-by-four redwood.

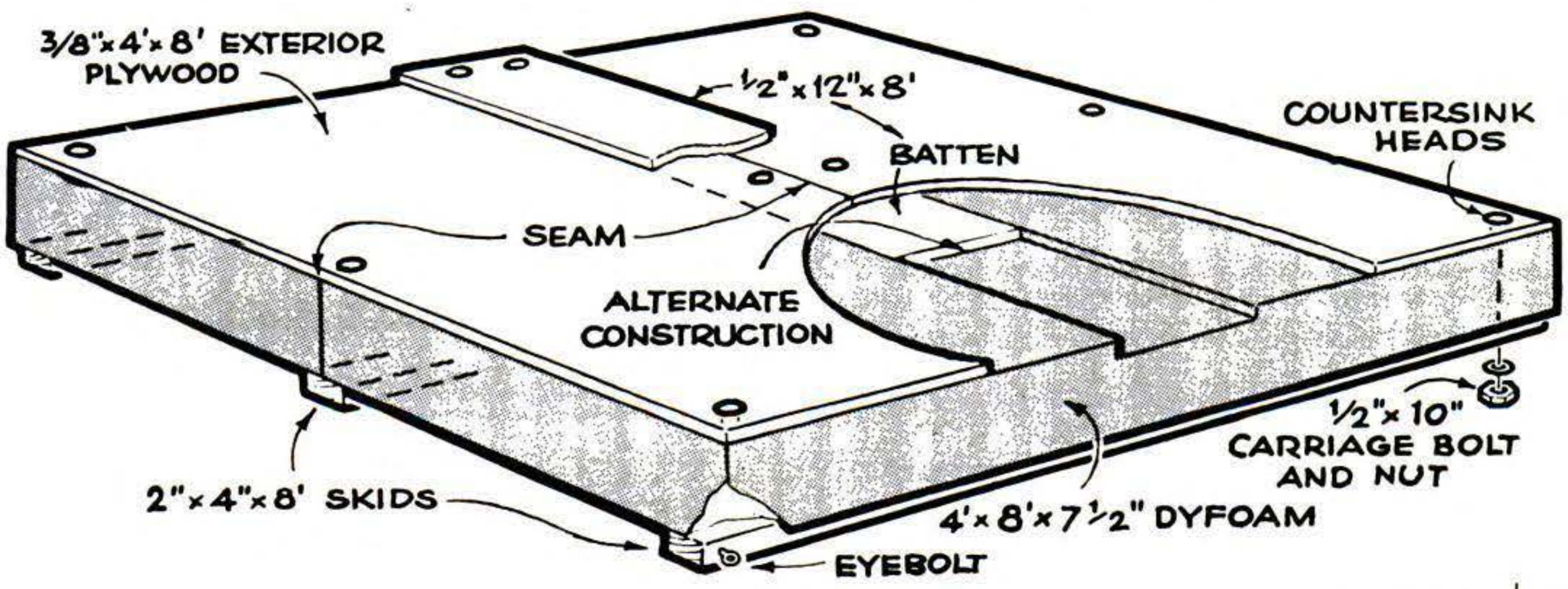
These parts are held with a 12″-by-8′ batten ripped from ½″ stock and ½″-by-10″ carriage bolts. Paint all parts with marine paint. Join the sheets and the batten with screws. Position the redwood lengths parallel on the plywood sheets and drill for the bolts. The outer skids should be about 6″ from the edges and crosswise to the joint between the sheets. Align the plywood deck, the billets, and the skids. Heat the bolts less than red-hot, insert through plywood into the billets (heat melts foam so bolts go in, but keep open flame away from Dyfoam). Place the skids over the bolts and secure with washers and nuts. Tie a concrete block to a ¼″ eyebolt for an anchor.



Raft is extremely buoyant and stable. It will hold a whole cavorting family without tilting, and can be anchored with a concrete block.



Lightweight construction, due primarily to the foam billets, makes the raft easy to transport to and from the water.



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Popular Science AWARD

Popular Science Monthly announces another in its series of Awards presented in recognition of companies and individuals making outstanding contributions to American living in fields of interest to PS readers. The ninth selection of the Popular Science Editorial Board:

Sheldon Coleman and The Coleman Company

The company, whose founder brought light to all outdoors, continues to brighten camping for sportsmen everywhere with new comforts and conveniences. Under the leadership of Sheldon Coleman, the company now makes a wide and growing range of outdoor recreation and camping products that have the same durability, safety, and ease of operation that marked the original Coleman lantern. Sheldon Coleman and the Coleman Company are fitting winners of the Popular Science Award for these outstanding contributions to outdoor living.

EUGENE S. DUFFIELD President — **ERNEST V. HEYN** Editor-in-chief

Smooth

How that fabulous family—the Colemans—made camping a spor you can enjoy in all four seasons

By HERBERT SHULDINER

It seemed like an item that might b doomed as soon as the first electri lines were run in—that gasoline mantl lamp that W. C. Coleman started sellin at the turn of the century when incandes cent electric bulbs were just coming int their own.

Not so. Instead of becoming obsolete it was improved—and the Coleman port able gasoline lantern became Old Reliabl to millions of outdoorsmen. Today' lantern is as modern and indispensabl to the man who likes to rough it as rocket to an astronaut.

Lighting up the woods. Over 18 millio Coleman lanterns have been sold to date with 14 million of them (Coleman est mates) still in use. Certainly these a most indestructible lanterns helped lea camping out of the dark ages. Late Coleman products—stoves, heaters, tents sleeping bags, coolers and jugs, traile campers—have smoothed the modern ve sion of roughing it.

Few people had enough leisure tim to rough it in the company's first decade But Coleman never stopped perfectin outdoor hardware. In fact, it was durin the depression-racked thirties that W. C Coleman's oldest son Sheldon took ove the firm's research and development pro grams.

He launched the company in th home-heating business and, by 194 Coleman led the nation in the produ

Continue

Sheldon Coleman and son, She don II, test catalytic radiant heat that has no flame. The heat comes in three models: 3,50 BTU, 5,000 BTU, and a unit th you can adjust to either ratin

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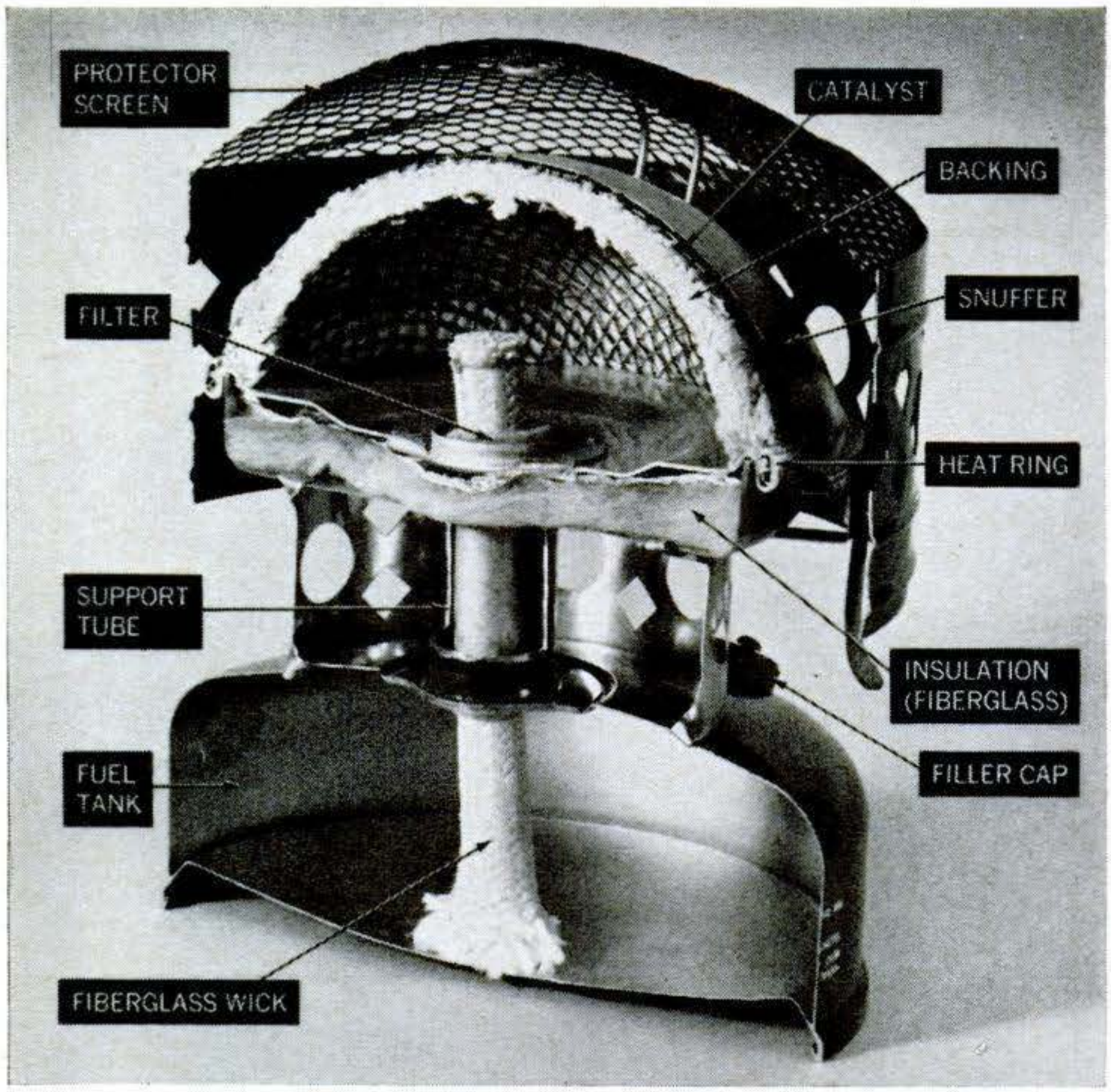
Way to Rough It

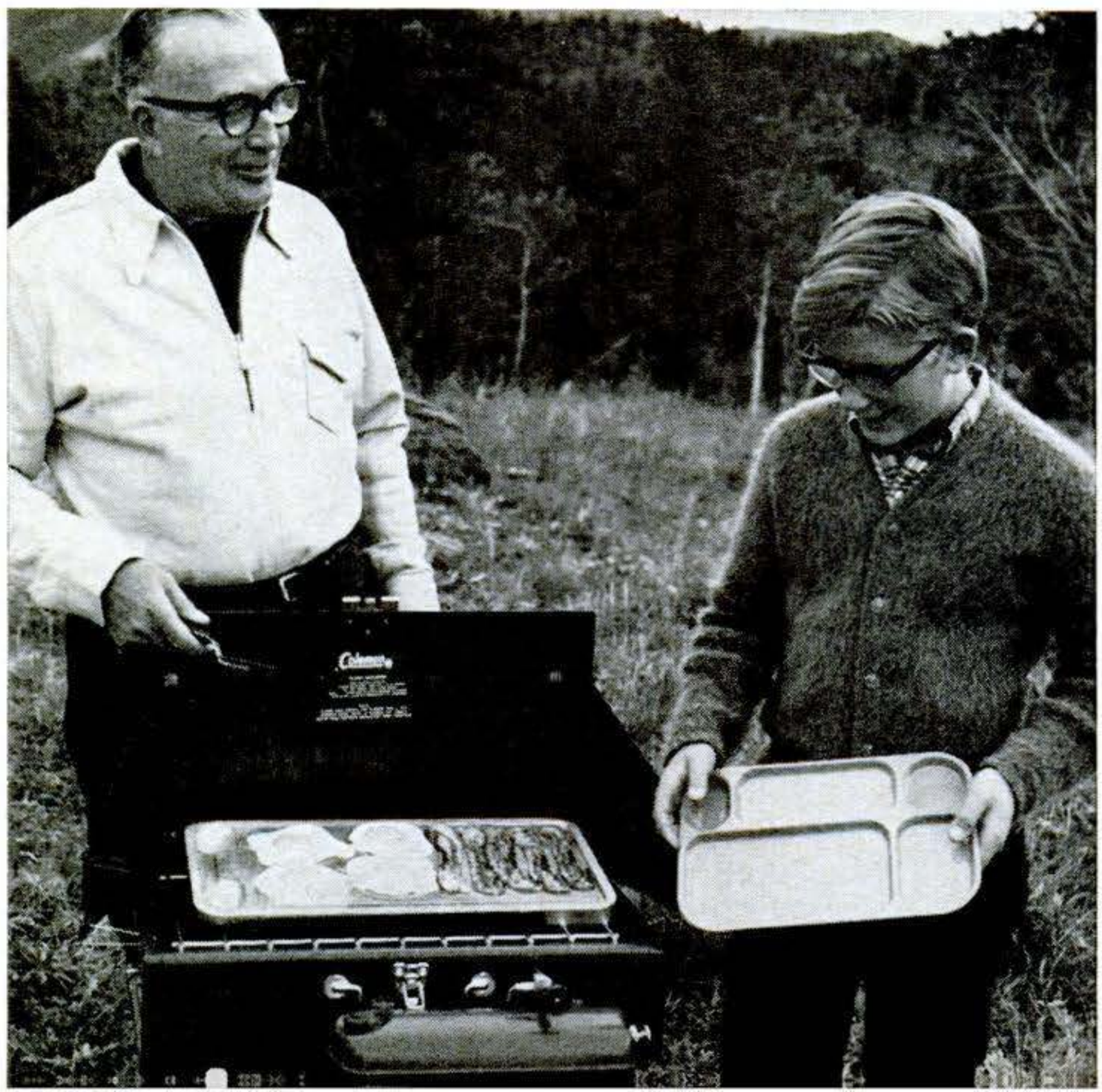
tion of gas floor furnaces and was a leading manufacturer of oil space heaters.

Forward into battle. World War II brought these activities to a halt, and Coleman turned its camping-hardware know-how to helping the war effort. More than a million lanterns and "pocket" stoves (the inspiration of today's one-burner Coleman Sportster stove) traveled with GIs all over the world.

At the same time, Sheldon Coleman prepared the company to meet an expected post-war demand for outdoor hardware.



Cutaway photo of catalytic heater shows how the wick carries vapors to the heating head, which has platinum catalyst that burns gas without producing flames. Below, Sheldon Coleman prepares breakfast for his son on regulation folding stove—long a mainstay of the Coleman line.



This planning sparked Coleman's growth, making them the largest manufacturer of camping and outing equipment in the world. Their plants turn out 4,000 lanterns (in half a dozen models, one of which burns LP fuel) and 3,000 sport and camp stoves every day. Coleman is also the world's largest producer of portable coolers and thermal jugs, second largest of tents and sleeping bags. And Sheldon Coleman says, "We expect to be the first in those areas within three years."

Instead of resting on these laurels, the company continues to search for new ways to help campers. "We're always probing the needs of people who live outdoors," says Coleman.

For years, the need for a way to satisfactorily and safely heat a tent was obvious. To fill this need Coleman launched into new research to perfect a catalytic heater. There were such heaters around but they had one major defect—their ability to provide a full-rated heat output diminished as the temperature plummeted, when heat was needed most.

Getting hot. A little over two years ago, Coleman perfected a white-gasoline-burning catalytic heater that could put out its full rated heat potential, regardless of how low the temperature got.

The biggest advantage

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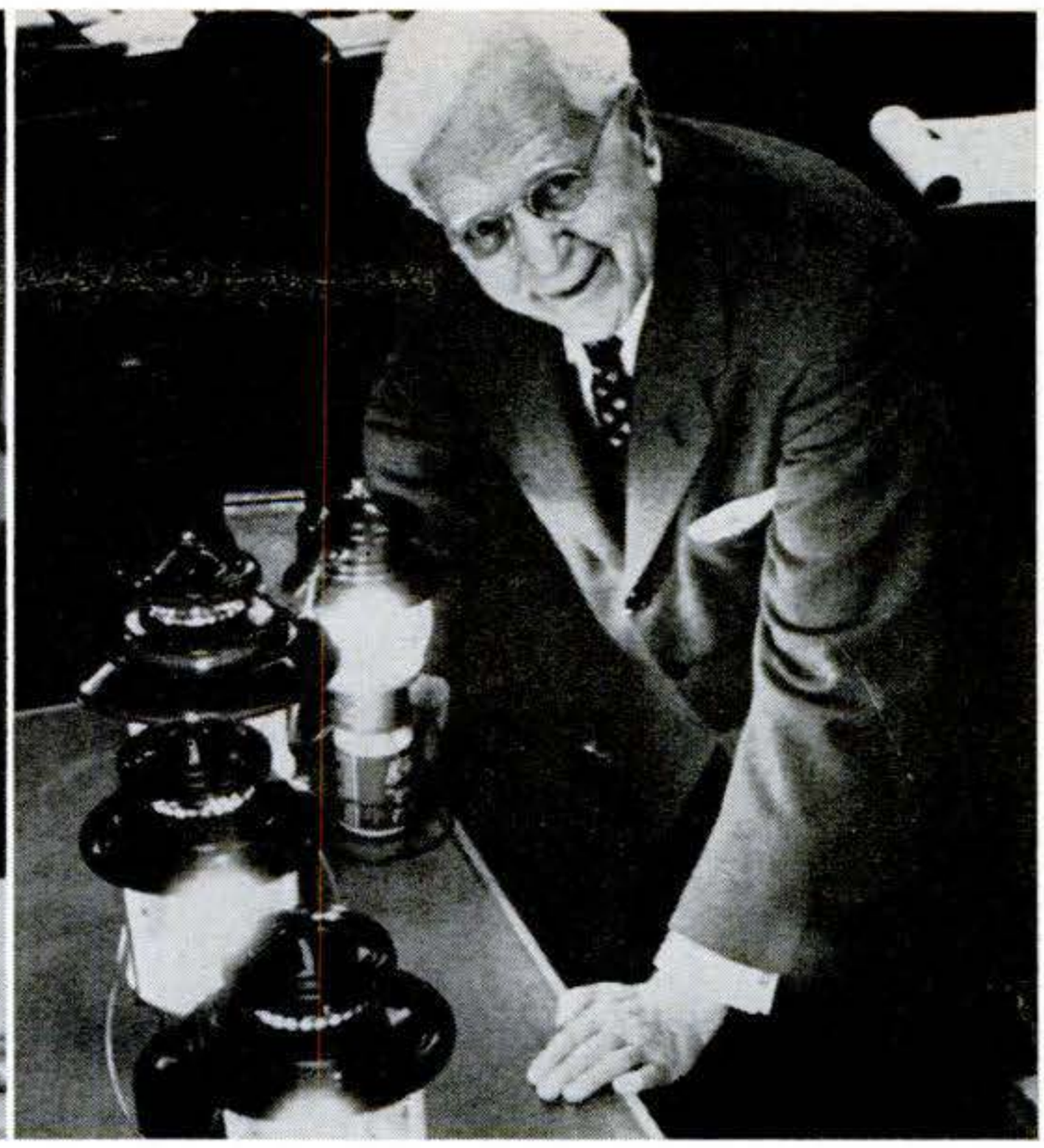
Efficient little heat maker, the catalytic heater burns up its fuel completely at about half the temperature needed for ordinary combustion.



The founder of the great outdoor-equipment firm, W. C. Coleman, displays some of the lanterns he perfected to provide campers with safe tent lighting.

the catalytic heater is that it's flameless. The heating head is impregnated with a catalyst of platinum dust (see cutaway photo). Combustion ordinarily takes place at about 1,800 degrees F. But the platinum catalyst enables you to get complete combustion at about 800 to 900 degrees—not enough to produce flame.

You can place a tissue on the heater's protector screen and it won't char, let alone catch fire.

How the heater works. Once the head starts burning, gasoline brought up from the tank by the fiberglass wick vaporizes under the head. A dense ⅝-inch refractory backing under the catalyst-impregnated head controls the flow of fuel and distributes the vapor evenly under the head. Outside temperature has little affect on the fuel's viscosity; it continues to flow consistently through the wick, allowing steady combustion.

One filling of fuel will warm you 18 to 20 hours—enough for two nights, depending on the temperature of the space you want to heat. The 5,000-BTU heater will raise the temperature of an eight-by-10-foot tent about 25 degrees above outside temperature. In tighter structures, you'll get more heat; in more ventilated ones, somewhat less. In tents, the heater gets its needed oxygen through the "breathing" fabric. But if you use the heater in a tight area, be sure to crack a window to replenish the oxygen consumed in combustion.

Besides heating tents, the catalytic heater is ideal for one-car garages, outdoor sheds, and ice-fishing huts. It is also handy for speeding the curing process for certain resins and other repair materials.

The huge success of the catalytic heater has sparked Coleman's current expansion program to meet the ever-growing need for outdoor equipment. "I can't see how this trend will change," Sheldon Coleman says. "The population is expanding rapidly and people are going to have more leisure time, not less.

"We're working on new materials to provide these people with new and better things. Some, like the four-layered Tri-Temp sleeping bag and the easy-to-erect exterior-frame Oasis tents, are two developments of this research."

What other new things will come from the remarkable Colemans can't be fully anticipated, but that their unmistakable label will be seen more frequently in the great outdoors in coming years is pretty certain. They're number one in outdoor equipment, but they keep trying harder. PS

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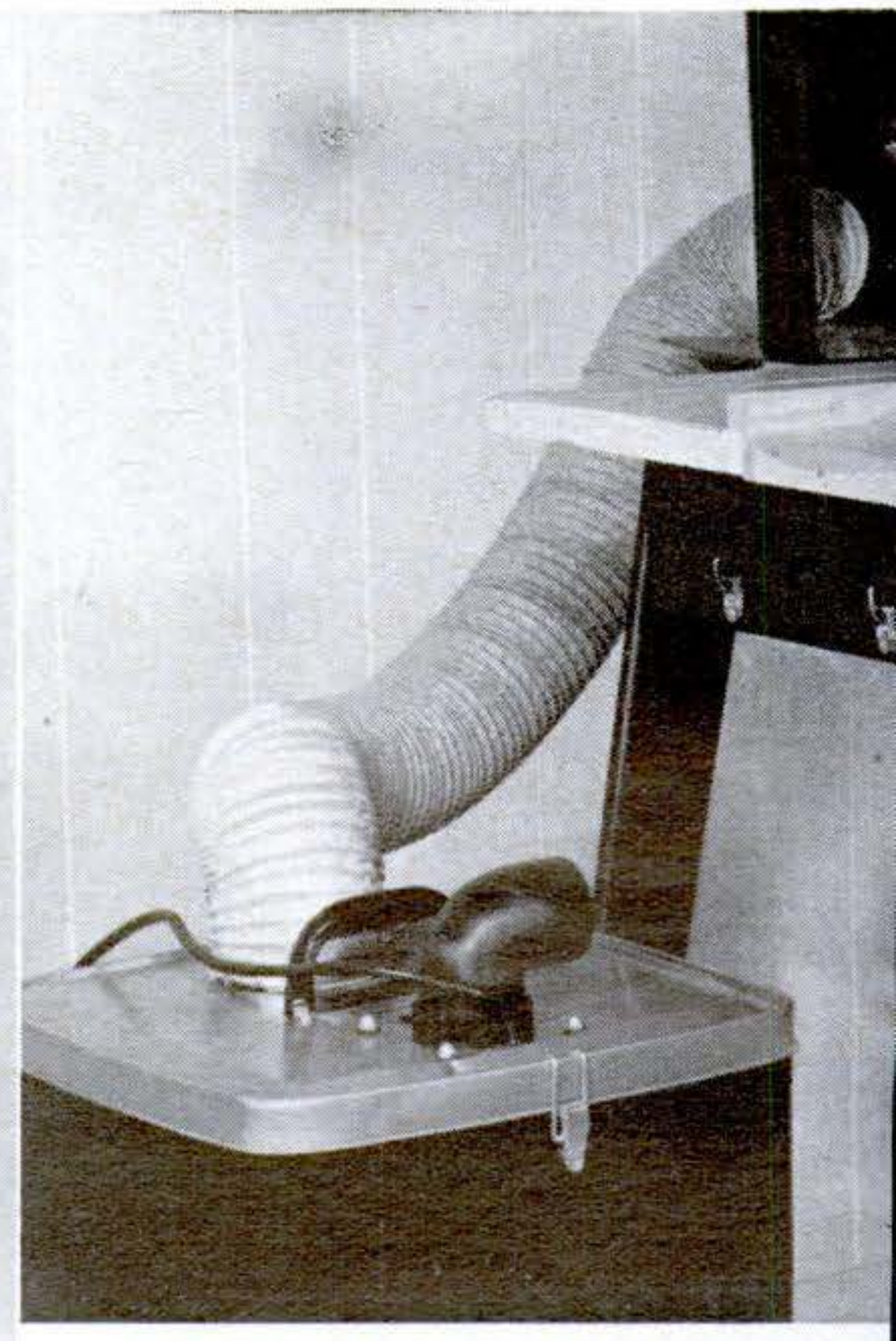
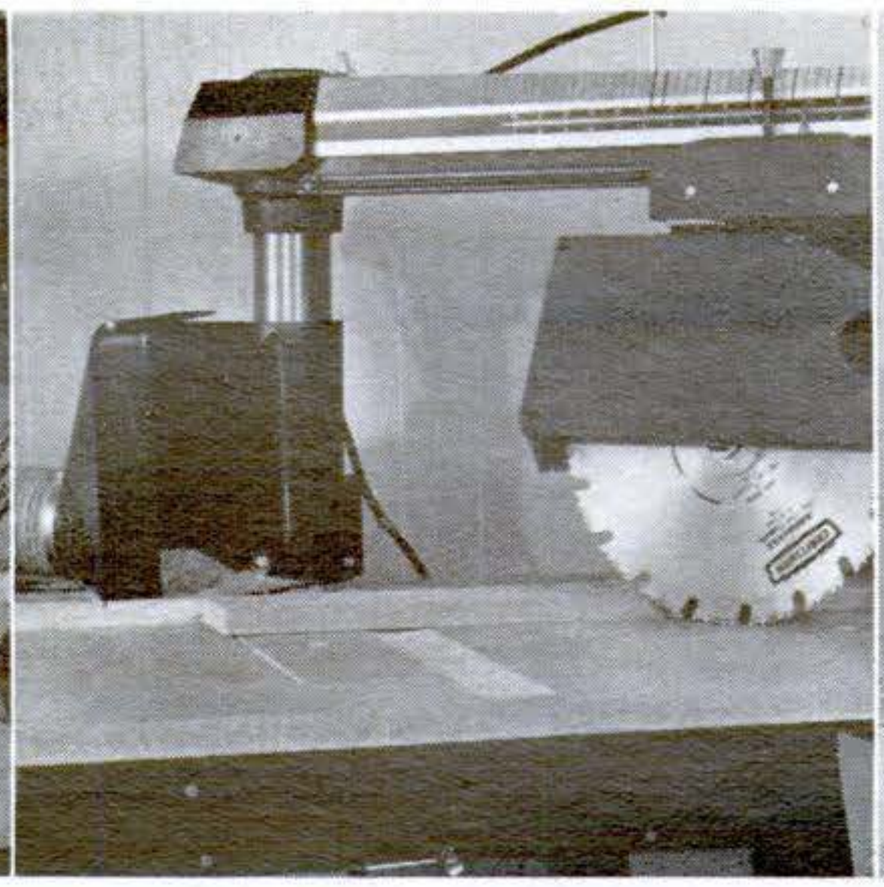
PERSONAL-USE REPORT:

New Sawdust Collector fo

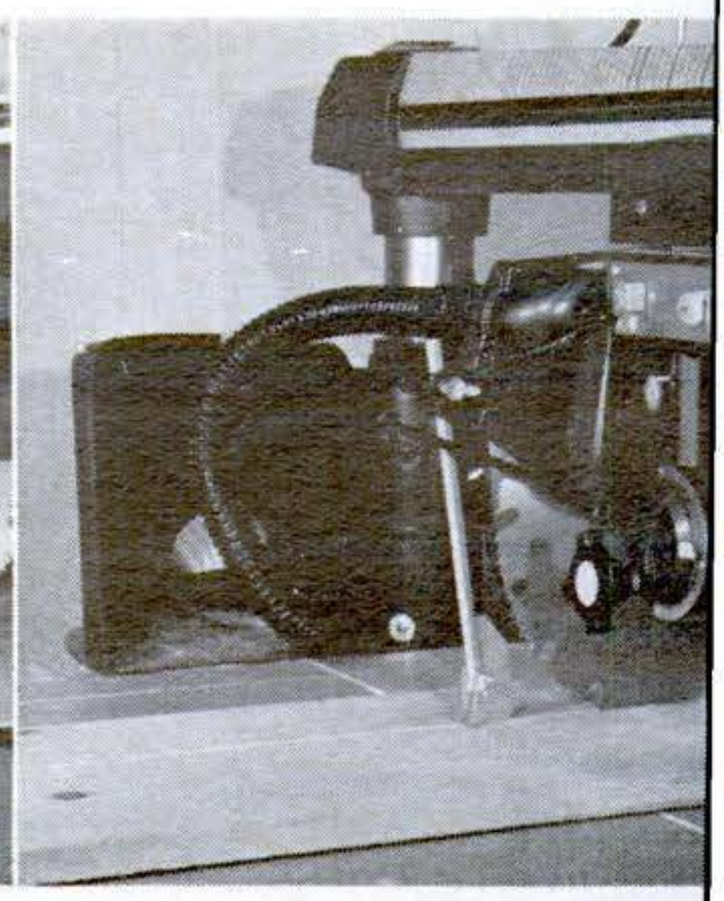


Dust container may sit on floor or hang prongs that are supplied (see above) attachment to saw stand. You can a put prongs on wall. Loosening one cla frees cleaner for other uses.

Trap normally is located directly in line with the cutting path of the saw blade. The trap catches the dust, and vacuum then sucks it down into the container. The trap has a cutout on the top edge so that it doesn't interfere with the full travel of the saw blade.



For mitering, you loosen a wingnut and rotate the trap to keep the opening in line with the flying sawdust. The 4" hose from the trap to the container is long enough and flexible enough to permit this kind of adjustment, even when the container is resting on the floor.



For ripping, you hook up smalle hose from saw-blade guard to th trap. It's not surprising that th unit is more efficient on cross-grai cuts than on ripping jobs. You ge maximum collection on rip cu when you tilt the guard so infee is slightly higher than the wor

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Radial Arms

By R. J. De CRISTOFORO

On cross-grain cutting, the blade of a radial-arm saw throws most of the sawdust on a predictable line toward the back of the machine. Trapping it there, and directing it to a container, is the idea behind a new Craftsman (Sears, Roebuck) dust collector.

Actually, what you get is an all-purpose vacuum cleaner for use throughout the shop. But special attachments adapt it to sucking in sawdust. It sells for $49.95.

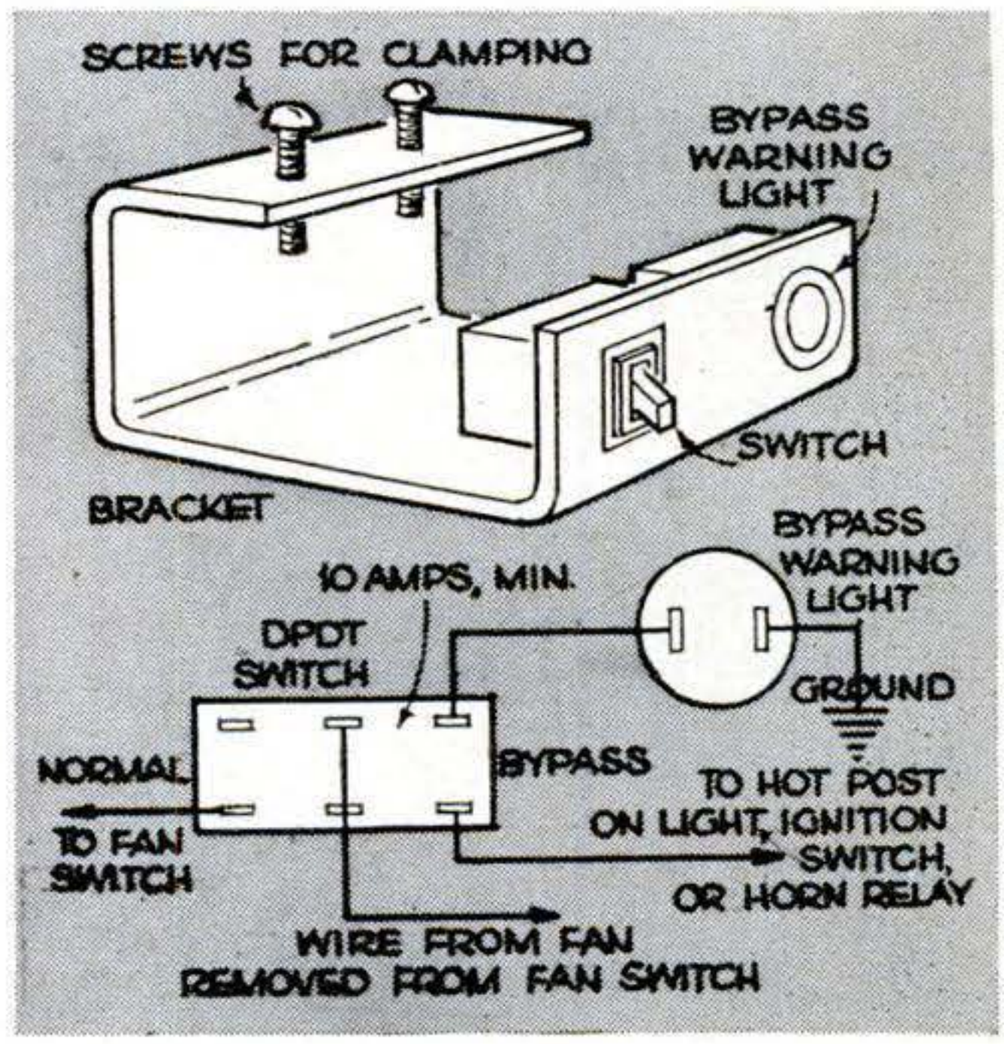
To attach the dust collector, you screw a flat metal plate to the back of the saw table. The plate has a vertical flange with a welded screw so the dust opening in the dust trap is a slot instead of a hole. The trap can be rotated and ideally placed for catching miter-cut sawdust.

For ripping, a smaller hose is used. A spring clip will hold it there, but it's better to insert the free end of the small hose into the outlet hose of the trap. Because of the difference in hose diameters a good deal of the suction is lost, and I wonder if it might not have been a good idea to end the small hose in a bell that would cover the full 4″ diameter of the trap hose.

The unit is especially suitable for Sears' products, but I could find no reason why it couldn't be adapted to other brands of saws. All radial-arm saws spew sawdust in similar fashion, so if the unit catches well for one, it will for others.

You can easily free the business end of the cleaner for general use around your shop and home. You need loosen only one hose clamp. The sawdust hose, trap, and trap support stay with the saw.

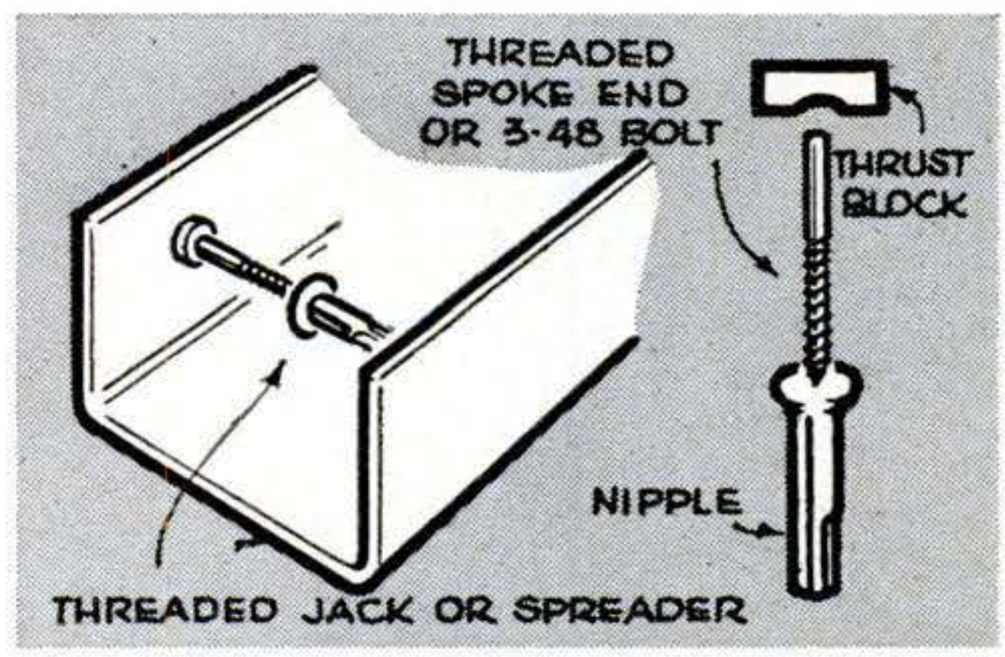
A hose adapter makes it possible to hook up all attachments for a conventional home vacuum cleaner to the unit.



Fan keeps Fido cool in the car

I used to worry about leaving my dog in the car in hot weather until I figured out this way of switching on the fan with the ignition off. I used a double-pole, double-throw switch rated for 10 amps. The diagram shows the details. The bypass warning light reminds me, when I return to the car, that the switch is in the bypass position. With the DPDT switch in the normal position, the fan switch takes over. The DPDT switch does not turn on the ignition.

JOSEPH SINGERMAN, Forest Hills, N.Y.



Midget jacks made from bike spokes

To reinforce light work that is to be sawed, drilled, or machined, midget jacks or spreaders can be made from bicycle spokes. The spokes should be cut to approximate length from the hub end. Reverse nipple for maximum adjustment.

HARRY WALTON, White Plains, N.Y.

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Gus beckoned Eldon under the car and pointed to the split line. Fluid beading the crack dripped to the floor.

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Gus and the Case of the Now-and-Then Brakes

The Akins kid had just got his license back after a reckless-driving charge. Now had he run into his accuser's car on purpose?

By MARTIN BUNN ILLUSTRATION BY RAY QUIGLEY

"Hide the chips, Boss. It's a raid!" sang out Stan Hicks, looking through the open door of the Model Garage.

Gus Wilson rolled out from under a car. "It's only Chief Eldon," he said. "Probably come for a cup of my good coffee."

"In *two* cars?" asked Stan.

Scrambling up, Gus saw that behind the chief's car stood a second squad car.

Sam Eldon unfolded his lanky body from behind the wheel. His movements were slow but precise; and behind the creased eyes—which, with his sagging jowls, always made Gus think of a dolorous bloodhound—was a wide-awake alertness.

"On your toes, Gus," snapped the chief. "This is official business."

"The kind I put in a bill for, and wait a month for the village to pay?"

"Sorry about that, Gus. See what you can do about this car they bought me last summer. Come December it was saying 'Who, me?' when I tried to boot it up fast, and dying any time I started up from a stop with a hot engine."

"Must be a *plainclothes* police car," cracked Stan.

"Our mechanic," Eldon went on, "reset the timing and the point dwell, and checked the automatic choke setting. At first that seemed to cure it. Two weeks later it wouldn't even start. We made the dealer tow it to his shop, where they put in new plugs, points, condenser, rotor, and finally a new fuel pump. But it wouldn't hold a steady 70 when I tried it. It accelerated, then slowed, then tried again. Surging, is what you'd call it, I guess."

"Sounds like fuel trouble," said Gus cautiously. "Was anything else done?"

"Sure. The dealer put on a new carburetor. Now I carry this"—Eldon brought a small hammer from under the seat—"to help start it by smacking the carburetor."

"Very scientific," said Gus drily. "I'll see about it. Want some coffee?"

"No, thanks," replied Eldon. "I've got to see about that Ron Akins kid; got his license back this week, and already he's in trouble over another accident."

Gus shook his head. "Too bad. Ron was too wild last year, when he lost out on that reckless-driving charge. But I thought that license suspension straightened him out."

"Seems it didn't," snapped Eldon. "I'll see you about my car this noon."

The engine of the chief's 1966 Ford was still warm when Gus got in to move it out of the way. The starter cranked briskly, but the engine failed to fire.

From what Eldon had said, Gus's first guess was that the trouble might be percolating fuel. He held the throttle wide open while cranking to empty the intake manifold. The engine still didn't start.

Gus got out and checked the carburetor vent rod, which should have bled off pressure, preventing percolation. The rod setting was to specs, the automatic choke open, its overtravel correct. In fact, the engine showed signs of competent care on the part of Ed Foyle, the police me-

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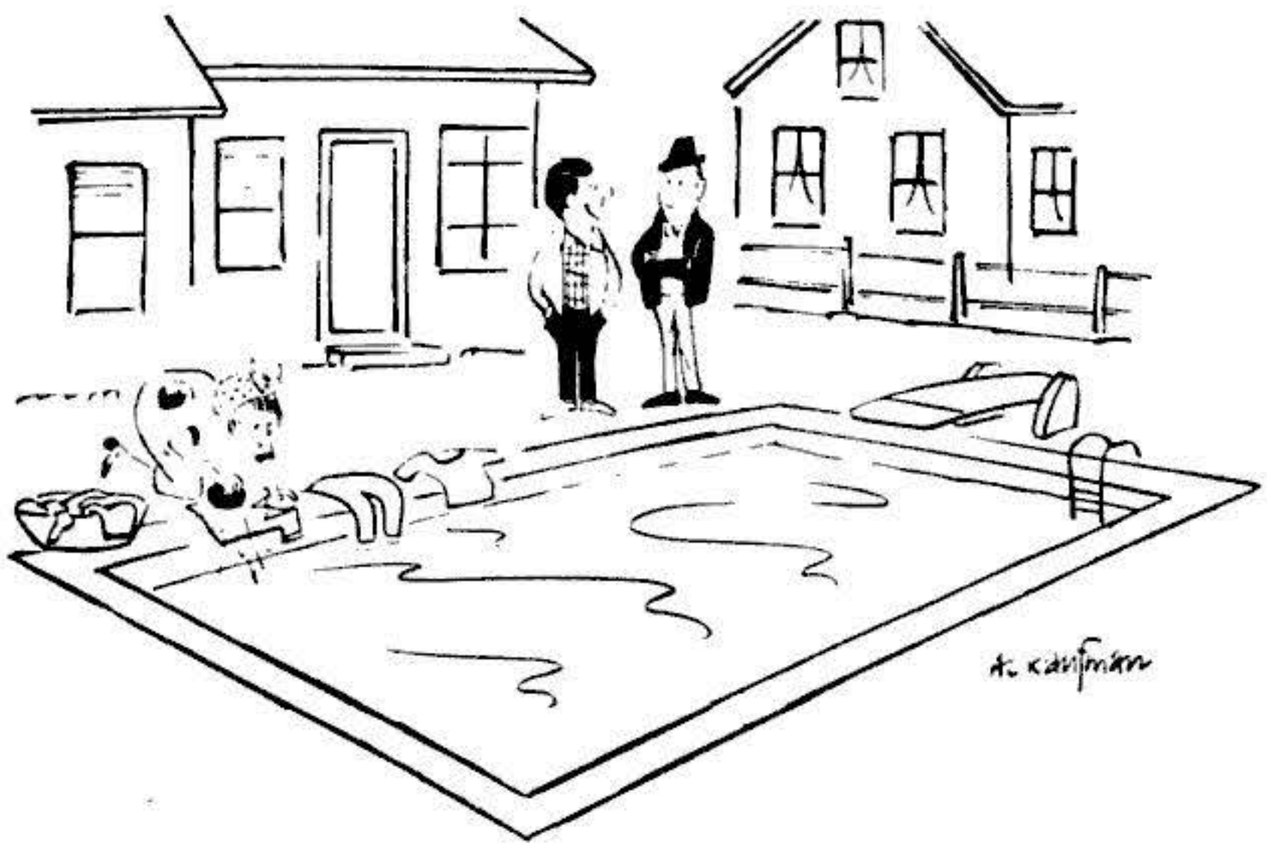
chanic. It was clean; the spark-plug porcelains glistened; the power-steering hose and neoprene fuel line were neatly strapped together.

A hot spark jumped eagerly when Gus held a spark-plug-cable end near the block and had Stan crank over the engine. Gus replaced the cable. Then, grinning wryly, he tapped the carburetor bowl as Stan again turned the engine over.

With a sputter and a roar, it caught.

"Like you said, Boss," remarked Stan as he got out. "That was real scientific."

Gus had just decided to blow out the fuel line when Eldon strode in whistling.



"She wanted a new washer, I wanted a pool —so we flipped for it."

"Not noon yet, Sam," Gus pointed out.

The chief waved a hand. "It's not about my car. Is that coffee still hot?"

"Sure. Come along." Gus led the way.

In the office, Eldon, his loose-jointed figure jackknifed into a chair, grasped a hot cup in both hands and stared thoughtfully at the black fluid.

"The car Ron hit six months ago was Russ Carter's. Not much damage, but it was plainly the kid's fault. For sheer vindictiveness, Carter laid a charge of reckless driving and made it stick. Last Monday the boy got his license back and started delivering for Jamison, the druggist. Jamison's a tightwad and doesn't pay much, but it's not every merchant who'd let a young fellow with a suspension record drive for him.

"At eight this morning, Russ Carter was stopped at the station light. Jamison's car came up behind and never stopped. It hit Carter's hard enough to dent his bumper, and jolted Carter enough to knock his hat off. When he saw who was driving, he yelled murder. Now he's claiming that Ron hit him deliberately to get even. He wants to charge vehicular assault."

"What evidence has he got?"

"The best," said Eldon. "It looks as if young Akins recognized Carter's car and rammed him deliberately. The man on traffic duty checked, and there wasn't a trace of skid marks to show Akins even touched the brake."

"What does Ron say about it?"

"That he had the pedal to the floor, but the brakes didn't hold. He says Jamison had warned him they were acting up, but the druggist denies it. Jamison is pretty huffy because we impounded the car. I have to hold Akins, too, but haven't booked him yet.

"After we'd had the car towed to the station," Eldon went on, "I tried the brakes myself. They held enough to lock the wheels. Either Akins is lying, or those brakes hold some times and not others. Could the brakes really work like that?"

"Let's go find out," said Gus.

The police garage was dim and quiet. Eldon went into the station house. By the time Gus had driven Jamison's old car in from the yard and onto a lift, Eldon was back with Ron Akins.

"Okay, tell it to Gus Wilson," growled Eldon, "and see if he swallows it."

"It's true, Mr. Wilson," said the boy. "Old Jamison did tell me the brakes were tricky. I wasn't doing more than 25 when I saw Mr. Carter's car stopped half a block away. I stepped on the brakes. When they didn't hold, I yanked up the emergency. But I knew it was no good. I had the pedal right down, but nothing happened, except we hit."

Gus nodded and walked under the car. One rear wheel showed traces of brake-

Continued

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November 18, 1966.

Dear Sarge:

I don't know exactly how to say it, but the fact is, I'm glad to be back in the Air Force. Why? Well, let's just say I found out the hard way that Air Force pay, privileges, medical care travel — they all add up — and compare very favorably with civilian life. Not only that, but when you think about all the other things — how much satisfaction I got from my job — the fact that I learned a useful skill — all my friends and buddies too — I didn't get all that in civilian life.

And I couldn't figure out how I was going to get retirement income (in the Air Force I don't have to worry about that either).

Besides I know I'm serving my country — and you can't beat that for living a worthwhile life.

I'm glad I re-enlisted.

All my best to your family Sir.

UNITED STATES AIR FORCE
Air Force Information, Box A, Dept. 77
Randolph Air Force Base, Texas 78148

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Put one of our new V-8's in some fast-moving traffic. Acceleration on any road (flat or steep) is what these engines are built for. Both GMC V-8's are surprisingly light and compact. Yet they develop either 175 or 220 horsepower.

Don't get the idea we've forgotten our in-line and V-6's, though. We offer all three kinds of powerplants, and we're the only people who do. The reason is simple enough. We want to give you exactly the right pickup for your

If you think all trucks are our new GMC V-8's eat up

GM

MARK OF EXCELLENCE

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work or play. So we offer V-8's for sprightly performance. We feature V-6's for tens of thousands of miles of durability. And we have an in-line that makes any job a low budget operation. Also, every pickup we sell has safety features like a padded dash, pushbutton seatbelts and more. But that's not the end of the GMC pickup story. You also get a ride as smooth as the family car. Call your GMC truck dealer. He has the pickup you need.

pretty much alike, watch traffic.

The Truck and Coach Division of General Motors

GMC

What a difference a name makes

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fluid leakage around the drum. Gus ran a trouble light along the brake line.

He stopped where it ran over the rear-axle housing, and rubbed off some of the grime. Where it was clamped, the line had evidently chafed and split. The dark stain of a big leak ran down the housing.

Gus lowered the car.

"Get in, Ron. After the car is up again, hold the pedal down hard."

The young man nodded, got in, and was hoisted aloft. Gus beckoned for Eldon to come under the car, and pointed to the split line. Fluid beaded the crack and dripped to the floor. Grabbing a wheel, Gus tried unsuccessfully to turn it.

"The brakes seem to hold all right."

Taking a feeler gauge from his pocket, Gus unfolded a leaf and thrust it into the crack. Fluid seeped onto his hand. He poked the gauge about, had to dodge the thin, hard stream that squirted out. With one hand he grasped a wheel. It turned.

"Proof enough, Sam?" he asked.

Stepping out from under the lift, Gus waited for Eldon to get clear, then lowered it. The boy got out.

"Okay, it could have been like Akins said. But why?" asked the chief.

"Because of gooey, gummy crud in the brake system," said Gus. "Jamison came to me once, hunting a bargain in brake fluid. He probably found it somewhere else—he must have been using a lot since that line split open. Under pressure, the split got bigger, while the cheap fluid he was using gradually turned into muck.

"Most of the time, gummy deposits plugged the leak and the brakes held. But when Ron hit them this morning, the goo had moved. Suddenly, no brakes."

Eldon swore softly. "I'd have had to book him if we hadn't found this. It's Jamison who should be in a cell."

Back in the Model Garage, Gus hauled an air hose to the chief's car and detached the neoprene hose at the intake side of the fuel pump. He looked at it thoughtfully. A minute later the engine roared.

Later that afternoon Chief Eldon came in. "I don't suppose a spade-thumbed mechanic like you has my car fixed yet," he growled.

"Take it away," retorted Gus. "It's keeping me from more important work."

"Akins is free," said Chief Eldon with satisfaction. "Carter's suing Jamison. I leaned on *him* about operating a car he knew to be unsafe. The boy keeps his job, and the car gets a brake overhaul."

"Been pretty busy, for a cop."

"Yeah. I even put a voucher through for your help, such as it was," returned Eldon equably. "How about my Ford?"

"Your boy Ed is too neat. He strapped the flexible fuel line to the power hose."

"Sure. I thought it was fine."

"Right—until underhood heat shrank that plastic strap he used. That strangled the line until the pump had a hard time pulling gas through it, especially when you floorboarded it. When you stopped with the engine hot, some gas boiled away and left a low level in the bowl. With that constricted line, it took a while for cranking to fill the bowl to normal level."

"Why did hammering the carb help?"

"It gained time for pump suction to drag gas in. Maybe sometimes it splashed a little that was left in the bowl into the main jet. Once the engine caught, it worked the pump fast enough to get more fuel."

"Okay, put in your bill."

"No bill this time," Gus said. "All I did was cut the plastic strap. I can afford to do that on the house—for free." PS

Triumph Spitfire gets more power

This Triumph Spitfire Mark III has a bigger engine that zooms it to a top speed of 100 m.p.h. It goes from 0 to 60 m.p.h. in 12.5 seconds. The new model also has a stronger clutch to handle the increased power. Other refinements: smaller, 15-inch adjustable steering wheel, and more powerful brakes with a heftier master cylinder and larger calipers for front disks.

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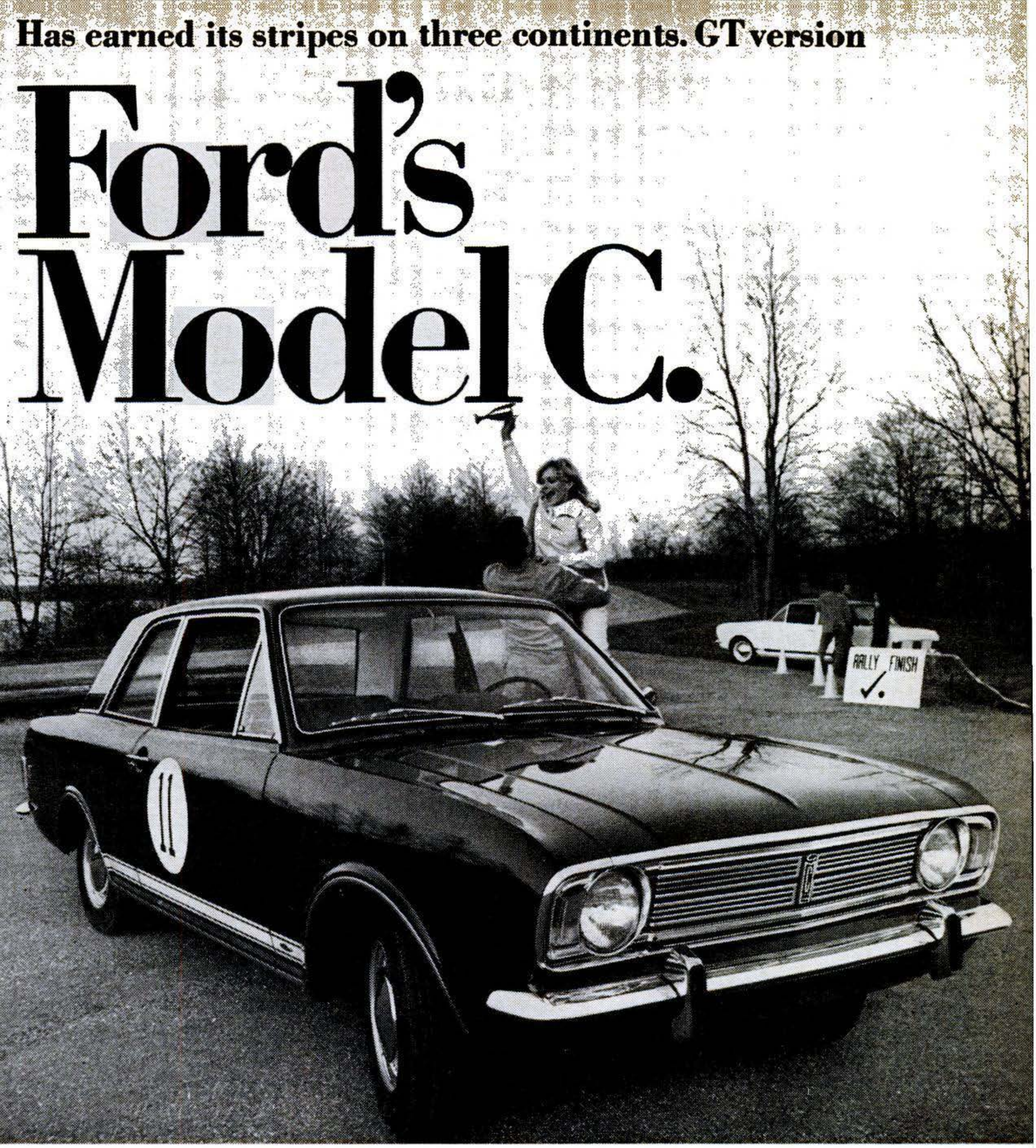
Has earned its stripes on three continents. GT version

Ford's Model C.



The Model C is Ford's new Cortina. The GT version shown here has a distinguished international racing and rally championship heritage built right in. (Specially prepared versions won the East African Safari, European Salon Championship, Canadian Shell 4000 and hundreds of other major events.)

And even if you don't rally, you'll like the Model C's other happy claim to fame—it's fun to drive. Razor-honed handling, sports-car performance, 5-passenger comfort—all at a sensible price.

All standard on GT

☐ Rally-proved 1500 cc ohv 4-cylinder engine.
☐ 83.5 bhp @5200 rpm, 97 lb/ft torque @3600 rpm.
☐ Weber carburetor and tuned exhaust headers.
☐ Full instrumentation including: tachometer, ammeter, oil-pressure and temperature gauges.
☐ Custom-contoured, individually adjustable bucket seats, and all-vinyl interior.
☐ Four-speed gearbox with short-throw gear change lever: fully synchronized.
☐ Individual front suspension.
☐ Front disc brakes: self-adjusting dual brake system.
☐ Self-adjusting diaphragm clutch.
☐ GT rally stripes and special insignia.

And a lot of other things going for you

☐ Aeroflow Ventilation—changes air every 34 seconds with the windows closed.
☐ Spacious room for five adults.
☐ A turning circle 6′ less than VW's.
☐ A trunk that holds twice the luggage of a VW.
☐ Optional wide-based wheels with radial ply tires on GT's.
☐ Ford Motor Company Lifeguard Design Cortina Safety Features.
☐ The Model C is sold and serviced by Ford dealers—backed by Ford Motor Company.

Take a test drive and watch your sports-car senses come alive. GT shown, **$2172*.**

Other Model C's from **$1815*.** Check the Yellow Pages for your nearest Ford Cortina dealer.

Ford Cortina

Ford

*Prices quoted are manufacturer's suggested retail base prices at East Coast P.O.E. The prices include Federal excise tax and suggested dealer delivery and handling charges. State and local taxes and transportation charges to your local dealer are additional.

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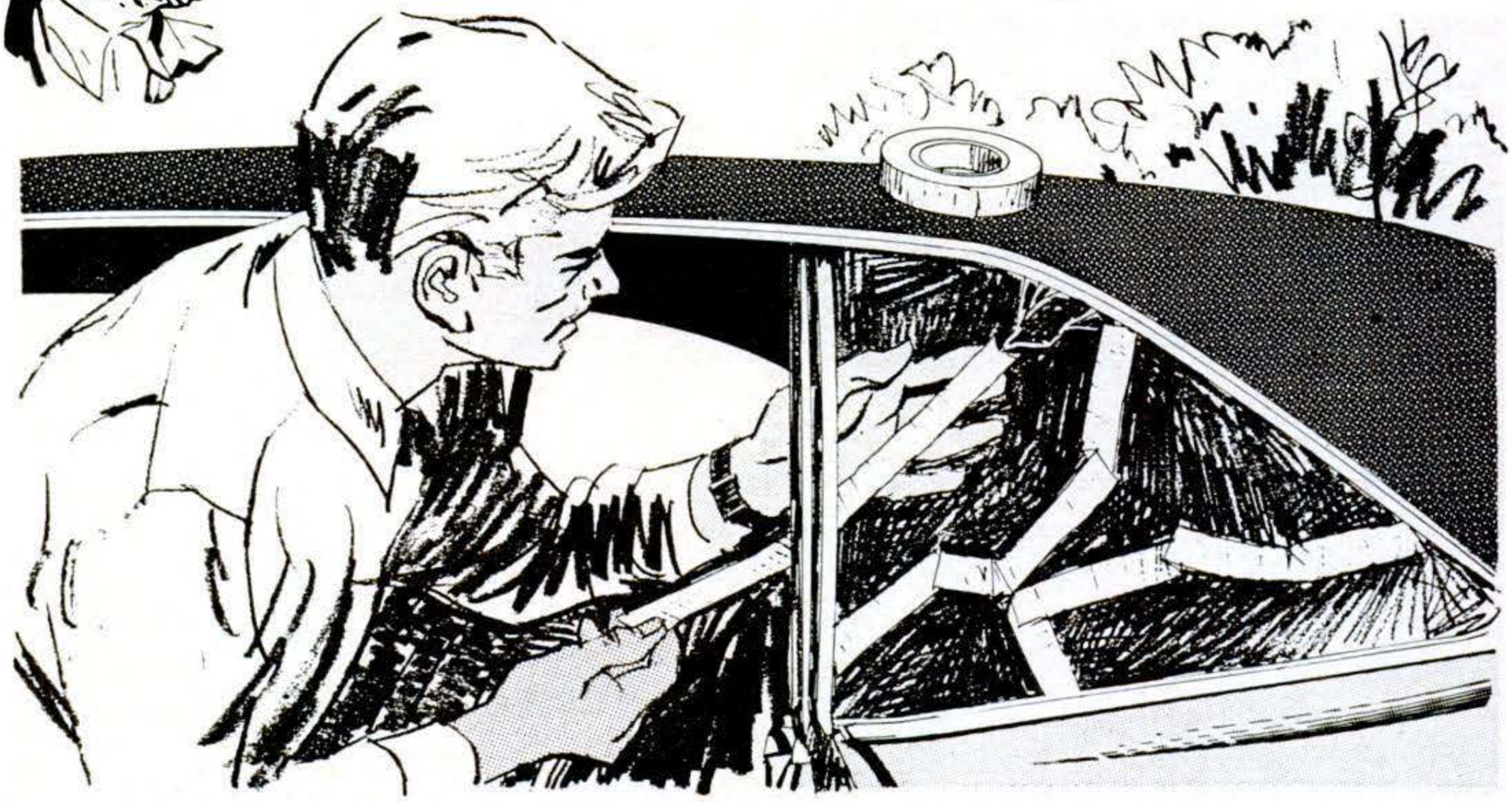
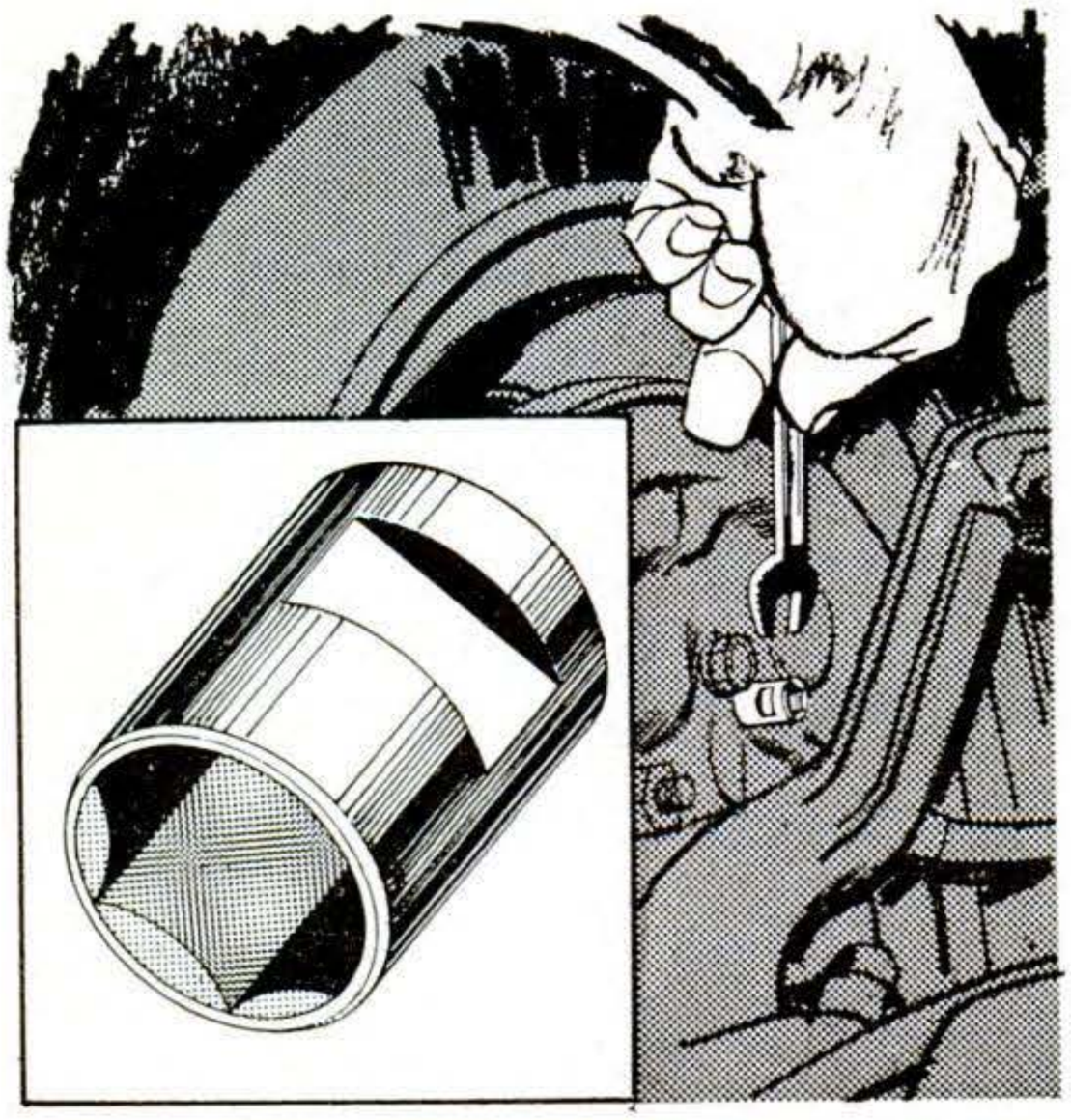
Hints from the Model Garage

DRAWINGS BY RAY QUIGLEY



When a glass panel is broken and a replacement job can't be done right away, here's an easy way to keep the fractured glass in place temporarily. Tape the cracks, inside and out, with masking tape. This make-do is safe as long as the window is not lowered and raised too frequently. When replacement can be made, the tape will hold the whole glass panel in one piece during removal. There will be no sharp bits or slivers to cut your fingers or damage the car's paint or upholstery. Clean window frame before inserting new glass.



The ¼" bleed screw on late-model Falcons and Fairlanes is too close to the spindle to let you get a socket wrench and handle in place. The screw is also too small for a normal wrench. Grind two flats on the outside of a ¼" socket to fit a 7/16" open-end wrench.

To fit a Phillips screw in a tight place, you often need to mount it on the tip of the screwdriver. To keep it from falling off, fit a small coil spring around the blade and bend the coil out to catch the screwhead. After starting, turn back half a turn to free the spring.

Continued

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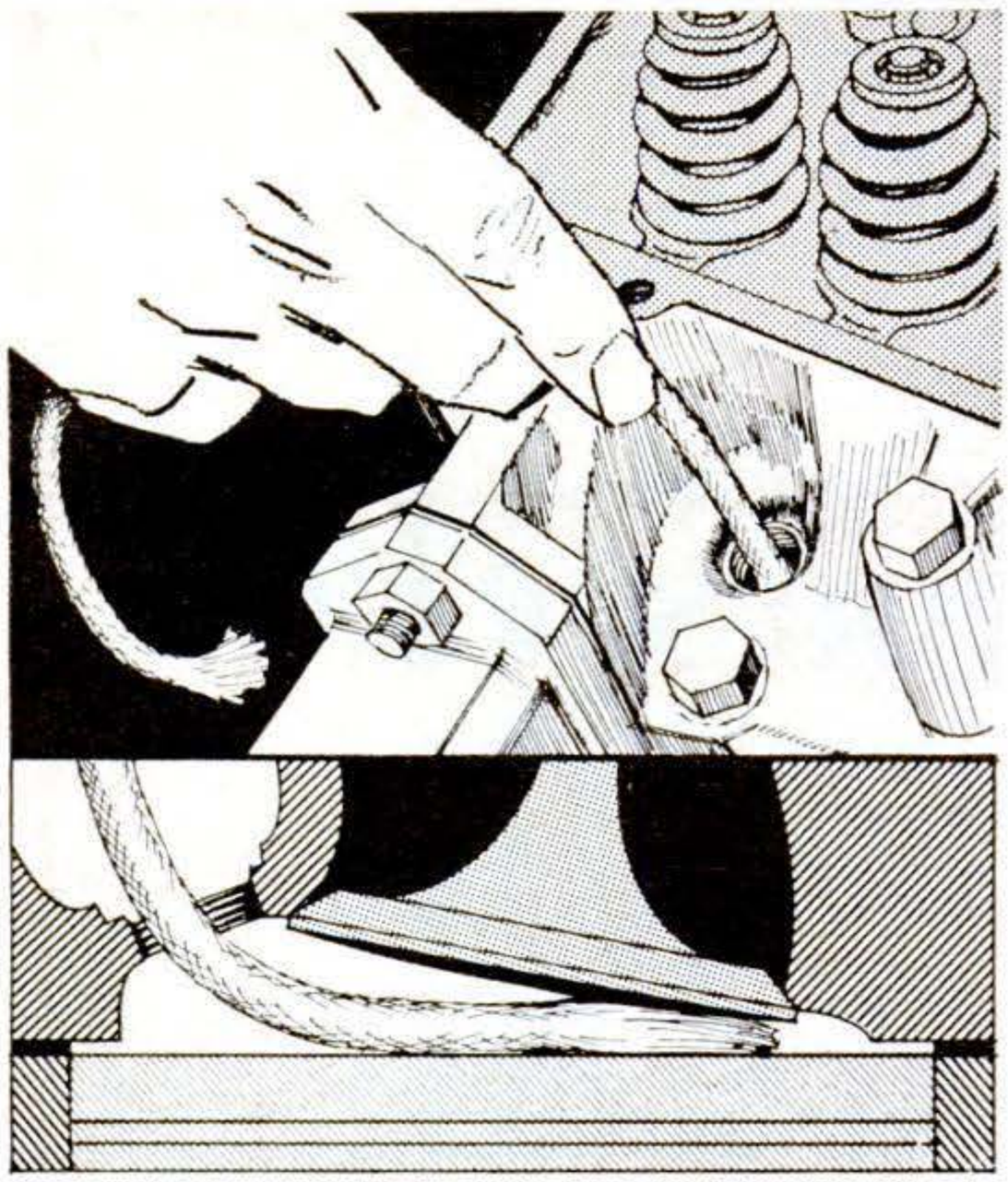
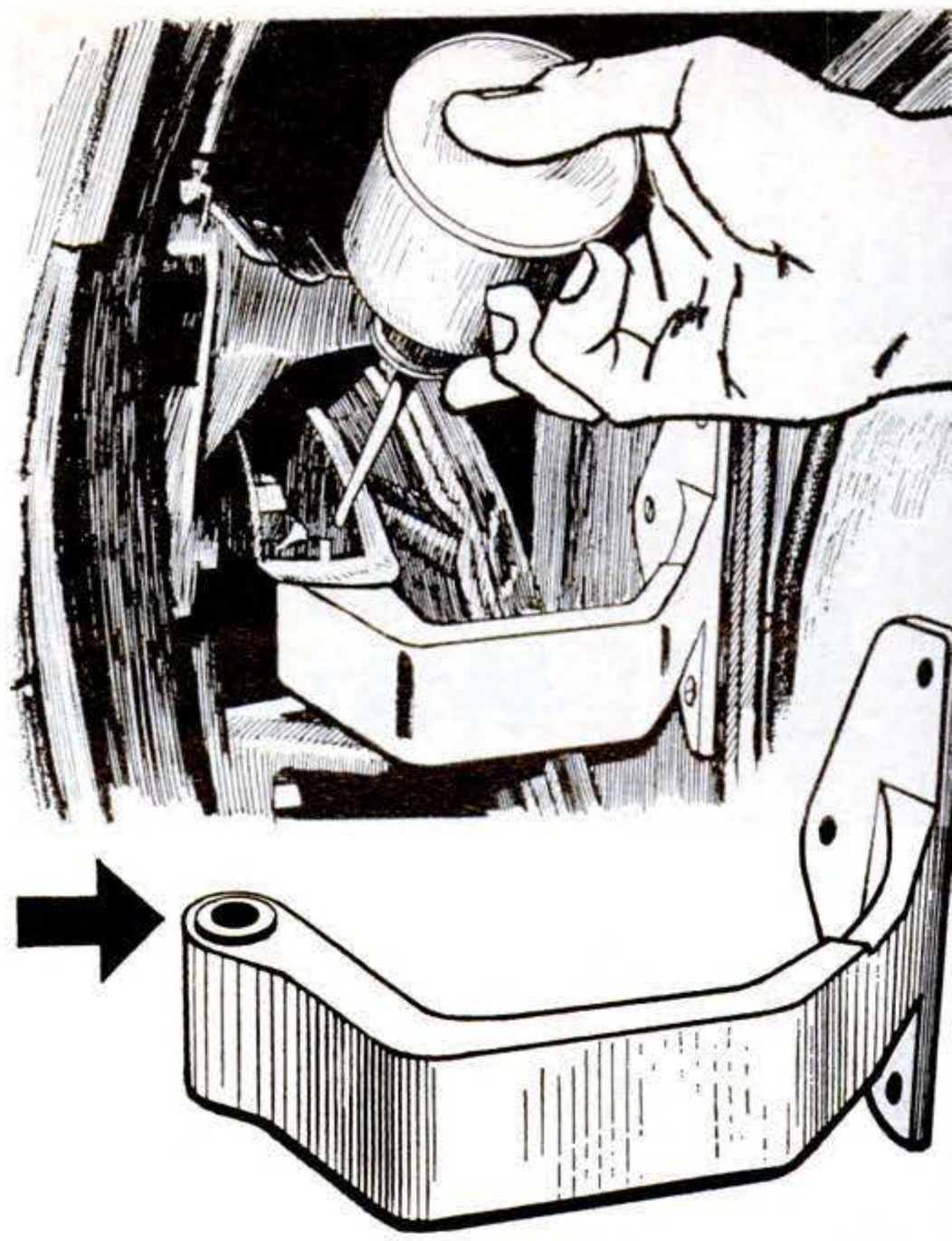
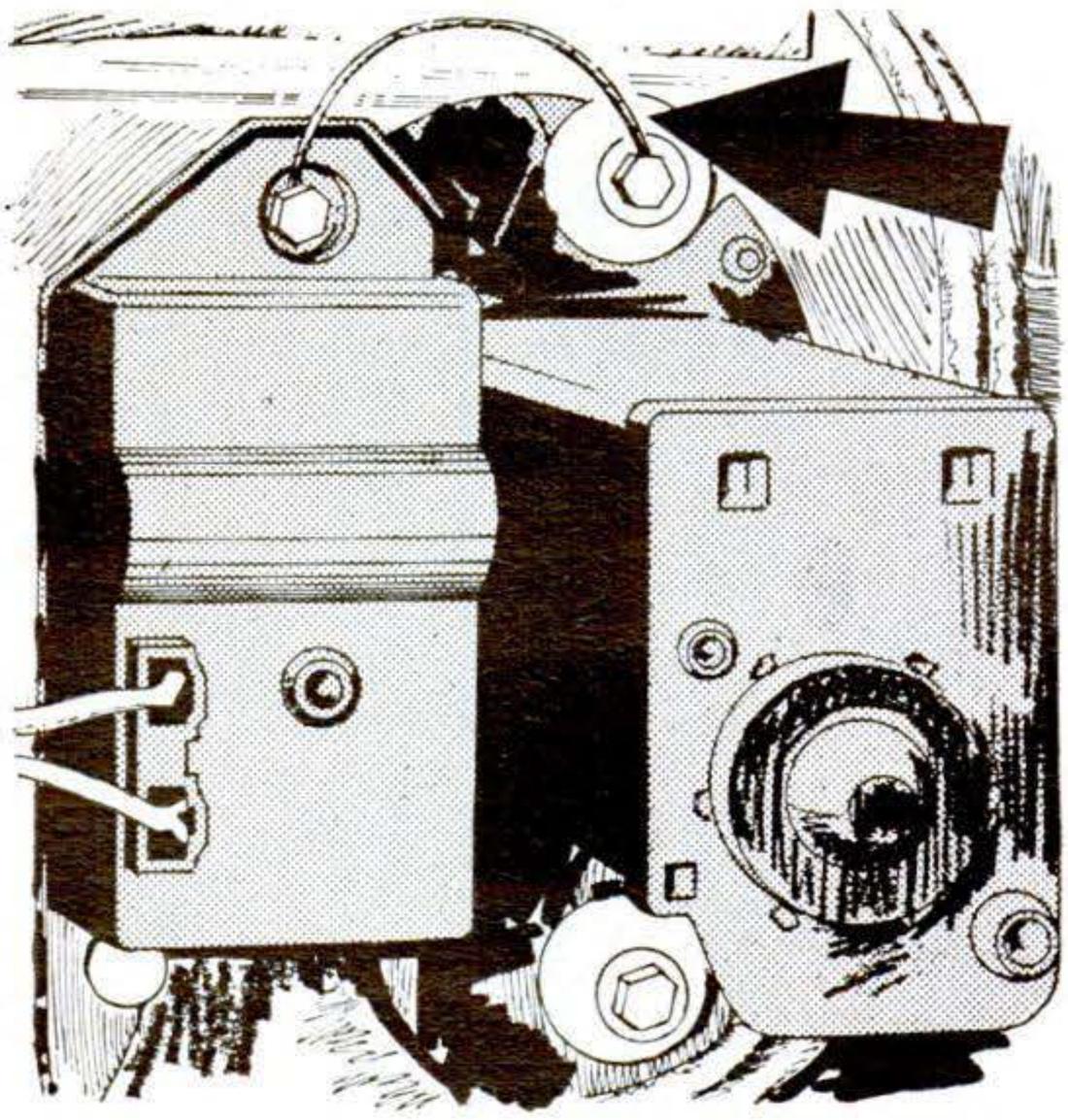
More Hints from the Model Garage



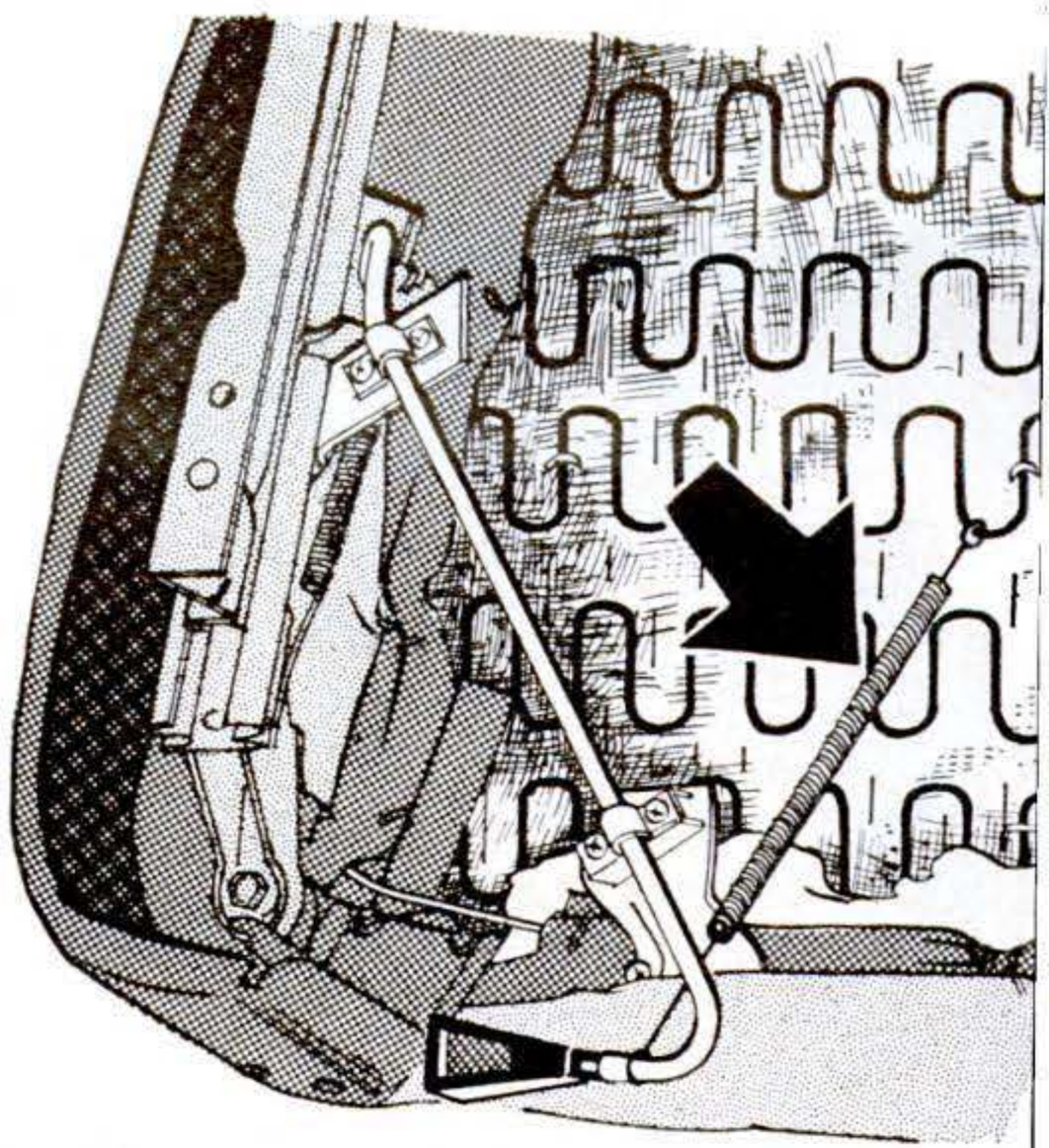
To replace neoprene valve-stem seals you must remove the valve springs. The manual says to use air pressure through the spark-plug hole, with the piston at top dead center, to keep the valve from dropping. If you have no air pressure, drop in a clothesline end.



Plastic bushings in the door hinges on Fisher bodies rarely bind. If they do, the best way to free them is with a few drops of transmission oil. This does a quicker job than any lubricating or penetrating oil. Some oils seem to make the bushings bind worse than before.



Radio interference in some cases can be traced to improperly grounded two-speed wipers. Here's a simple way to provide proper grounding: Install a 14-gauge stranded wire between the switch plate on the wiper motor and the motor mounting plate.



Rattles from front bucket seats may be caused by the adjusting handle fouling the seat frame. Fix it by fitting an accelerator retractor spring between the handle rod and one of the seat springs. The handle will remain quiet when the car is on the road.

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How to Get Full Value from a Home Tractor

If you're a new owner of one, here's good advice on how to use it

By C. L. BREK

Now's the time, in the heat of summer, to consider mowing your grass higher. Modern tractors make the adjustment job much easier than it used to be.

There's the old story about the dog that chased trains, and the comment of the gray-whiskered stationmaster. "Durn dog," he said, "what would he do with it if he caught it?" Garden-tractor owners are sometimes in the same boat. Now that you have that new tractor, what are you going to do with it?

Three things are required of a tractor—that it have enough power to do the jobs you have to do, that it have the versatility to handle those jobs, and that it be safe and convenient to operate.

You should have a reasonably good idea what your chores consist of. The first seasonal job that presents itself each year is preparing your vegetable-garden plot. The secret is to get ready early.

There's a right time for everything. Plowing is no exception. There is a time when the ground is right, in early spring. The moisture content is right, the weather is right. Get the garden ready for plowing, and equip the tractor with the right attachment.

Some tractors have a turnplow. Others have tillers—either operated by the tractor or by a separate motor. Some are unique, like the rotary-plow attachment. This turns the soil very swiftly, and leaves it in perfect condition for planting with one trip over.

Preparing for lawn chores. Before you leave the tractor, get ready for the next job—mowing, probably. So, before the grass starts to grow, get the mower out, lubricate it, check the belts and blades. If the blades are nicked or have been sharpened until they have lost their original length or shape, replace them. Then attach the mower to the tractor. When the grass grows, your tractor will be ready. If any miscellaneous jobs come up in the meantime (like hauling or rolling) the mower won't interfere.

Rolling is must treatment for some lawns. If your section of the country gets deep freezes, frost will heave what are known as "soft lawns." The thing to do is to attach a roller on the first reasonably dry days in spring and roll the lawn. A spreader is also a good investment.

The right mowing attachment. Lawn mowing resolves itself into a few basic rules. Select the mowing attachment that suits the lawn. If you want your lawn

Continued

Editor's note: The writer of this article knows his home tractors. He has had more than 20 years of experience in selling and using the machines.

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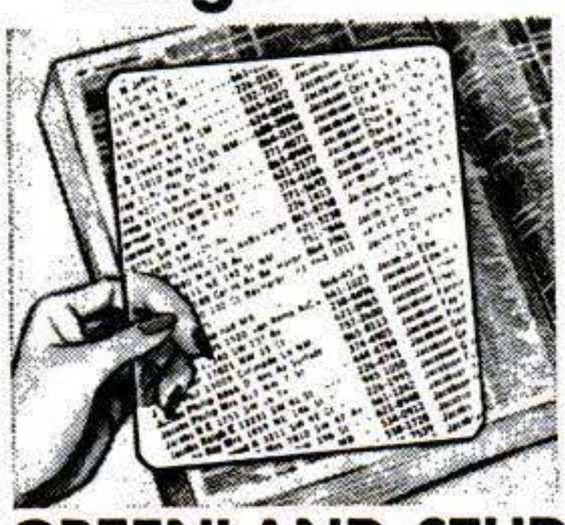

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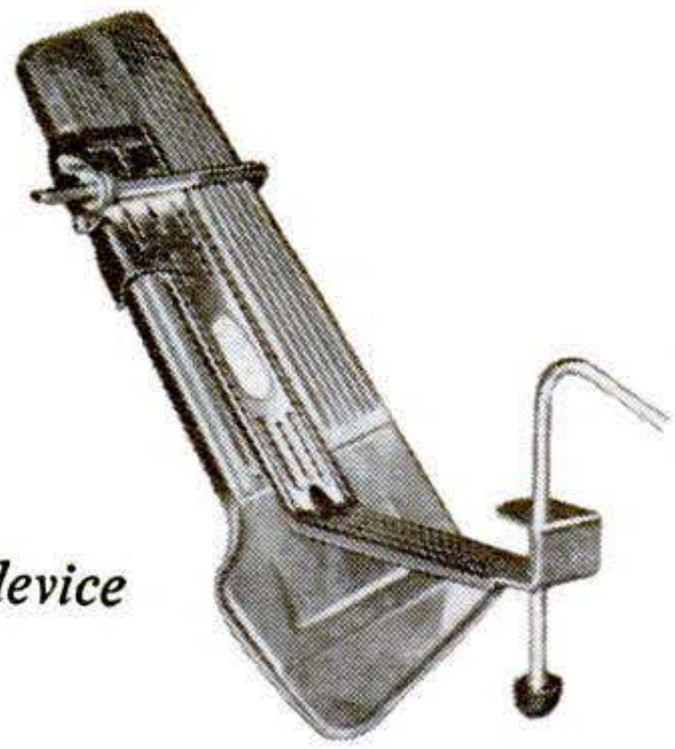

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What does this symbol stand for?

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to look like a velvet carpet, reel mowers are best. Some rotaries also will do a fine job, but it pays to look critically and select the one that meets your needs. You may find a variety available for your tractor, both in type and quality of cut. One tractor manufacturer presents a choice of three rotary mowers, two reel mowers, and a sickle mower for use on one tractor.

The size of the mower depends on acreage and obstacles. Use the largest size that will allow you to maneuver efficiently. This gets the job done faster, and the fewer times the tractor goes over the lawn the better.

In early spring or after a rain, it is possible to rut a lawn deeply with a small tractor. But the manufacturers offer several optional items to solve this problem. For instance, very wide tires distribute the weight over a larger area. Standard tires mounted in duals serve the same purpose.

Rough-land mowing. Even when this is done only a few times a season, to clear new land of brush and weeds and turn it into a passable lawn, it presents problems. Most people have found that underslung mowers are at a disadvantage in this type of work; the nose of the tractor will hit trees, bushes, and stumps before the mower can get the cutting done. A lot of hand work remains when the tractor work is done. A front-mounted mower takes care of the problem. Another advantage: You can always see better to mow in the corners and up under obstacles than with the underslung type.

Much is made of the ability to adjust height on mowers. The practical fact is that most users don't bother. When you find the right height for cutting your lawn, set it and forget it. The only time you really need to adjust height is in prolonged dry periods. Then you want to cut high to avoid burning up your lawn. Or perhaps you can't get through at the usual cutting height because you goofed off and went on vacation, or it rained three straight weekends. The new tractors make the adjustment easy.

Some tractors are better for garden cultivating than others. Power cultivators and tool cultivators can be attached and removed in a jiffy. A couple of runs and the main job is done.

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Then put back the mower attachment ight away. Mowing usually is done on a veekend or in the evening, when you can't afford to waste valuable mowing time changing attachments.

The fall, for many home owners, is the usiest time of the year. Leaf disposal s one of the onerous jobs you can do vith your tractor. It beats hand-raking ll to pieces. In the garden, harvest is ver. Mow the stalks down for appearnce and to destroy any pests that might e hibernating in them. Treat the garden vith fertilizer or organic material. Perhaps you'll want to plow it up again and plant a cover crop. This should be done efore the snow flies in the north, and at he right time in the south, usually late October or November. You may also vant to spray some trees and plants.

Getting ready for snow. Once the fall hores are done, get the tractor ready for vinter snow removal. Mount the blade r blower well beforehand. Check the ractor manual about winter lubricants. Some tractors start hard if you have summer-weight oil. Drain the old gas if you plan to let the tractor sit unused for a nonth or so. Have a can of fresh ready. This is also the ideal period to have your ractor checked by your local dealer. Cold weather demands that it be in top condition to fire and go when you need t. For good traction in snow, you may need chains on the tires, wheel weights, r perhaps dual wheels.

If you have only light snows, you probably can get by with a blade-type plow. A snowblower becomes a necessity if other snowstorms arrive while the first snow s still on the ground, or the wind drifts he driveway full every night.

Other home jobs. All through the seaons you can do many other things with vour tractor—saw firewood, aerate your awn, generate electric power, pull a cart or miscellaneous hauling. Many attachnents are available. Before you buy, be ure you have a plan for using them.

One final word: Think safety at all imes. Drive, ride, or guide your tractor vith the same care and attention you do our car. And be prepared to handle mergencies—know what to do, and have healthy respect for the powerful tool hat is saving you so much work and aluable time. PS

Don't fiddle while you roam.

The KODAK INSTAMATIC 804 Camera lets you concentrate on what you're seeing. You simply drop in a film cartridge and wind the spring motor. Your 804 makes all the correct exposure settings, even for flash as you focus. It advances the film automatically, turns the flashcube, too. The lens is fast, the viewing bright, the range-finding accurate.

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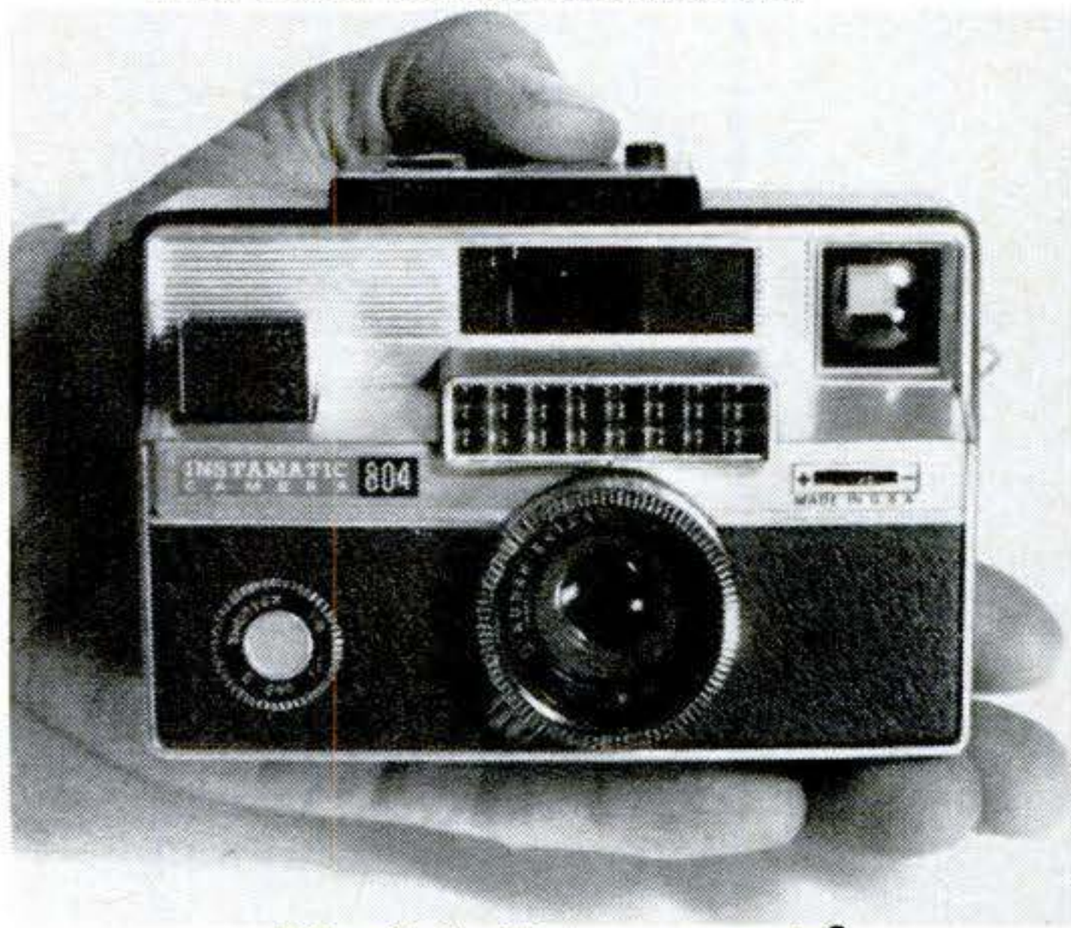

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Our First Ferry to the Bottom of the Sea

[Continued from page 49]

This contrasts with conducting sea-bottom operations remotely, all the way from the surface, with divers "hanging on a string." It eliminates need of a surface diving tender, with four-point mooring—which may have to be repositioned, by trial and error, until it is over the right spot. Deep Diver seeks out the objective and puts divers right there.

You enter Deep Diver through a hatch atop a conning tower that is ringed with eight ports. These give the pilot a full-circle view. Thirteen more windows, in the two compartments, aid in reconnoitering a work site and planning the divers' work before they go outside.

It goes every which way. Powered by storage batteries, Deep Diver can maneuver in tighter places than a submarine has ever been in before. Not only does it go forward or backward. It has complete three-axis control at zero speed, unique for submarines; it can move up, down, or sideways, turn clear around, or be put in any attitude, while it is motionless in other respects.

To do these things, the 8¼-ton craft uses a novel system of propulsion. Its main propeller, astern, swivels 90 degrees to either side. A double-ended thruster moves the stern up and down. And a sideward-pointing propeller, in a "nose cone" that rotates through 360 degrees, deflects the bow in any direction.

This craft is intended to go as deep as 1,350 feet. Submerged, it has a top speed of four knots. It descends and ascends at two feet a second.

Deep Diver is mechanically capable of putting out divers at a maximum depth of 1,250 feet. Still to be learned is how nearly that figure, far beyond today's records for useful diving, can be approached in practice. But current experiments are so encouraging that a depth as great as 1,000 feet, even though it means water pressure of more than 400 pounds to the square inch, looks to me attainable in the not-too-distant future. That would bring virtually the whole expanse of the world's submerged continental shelves within reach of submarine-borne divers.

What can Deep Diver do? Here are tasks such a craft could perform:

A submarine work boat like Deep Diver would be ideal for installing and maintaining the "Christmas trees," or wellheads, of offshore oil wells. Its divers could build and repair undersea oil pipelines, which are growing in extent; before long, we will see networks of them in the Gulf of Mexico and the North Sea.

It could lay, inspect, and repair submarine cables. In the field of defense, it could install and maintain the anti-submarine-warfare devices of an underwater "Dew line."

Lifesaving. An important use could be as a rescue vessel, for divers working on large-scale underwater projects. For instance, if a hard-hat diver got his lines fouled, Deep Diver could bring a team of rescue divers right to the spot.

Deep Diver might well be put to use in recovering valuables from sunken vessels, whether modern or of the past. I can imagine bucketfuls of treasure-ship relics and gold and silver coins being handed right into the submarine, instead of being hoisted to the surface on long lines.

Or, to look ahead a little, consider the prospect of fish farming to provide needed protein food for the world's exploding population. On an underwater fish ranch, Deep Diver would permit a diving ranchhand to patrol breeding grounds and make needed repairs, much as today's ranchhands get around by truck or horse to inspect and mend fences.

One special advantage of this unusual vehicle is that it enables divers to work despite strong currents or heavy seas above, which might hamper the effective operation of a tethered diving bell. Another is that an engineer, untrained as a diver, can descend in the pilot's compartment under normal atmospheric pressure. Thus he can observe the divers' work, instruct them in procedures, and make an on-the-spot survey of progress.

People who have tried "locking-out" to the sea bottom from Deep Diver, including Jon Lindbergh, Dr. Wernher von Braun, and Walter Cronkite, are excited about its possibilities. It is a revolutionary submarine. But we feel that the most descriptive word for it is "practical." It is a newly available and effective tool to do jobs that need doing right now. PS

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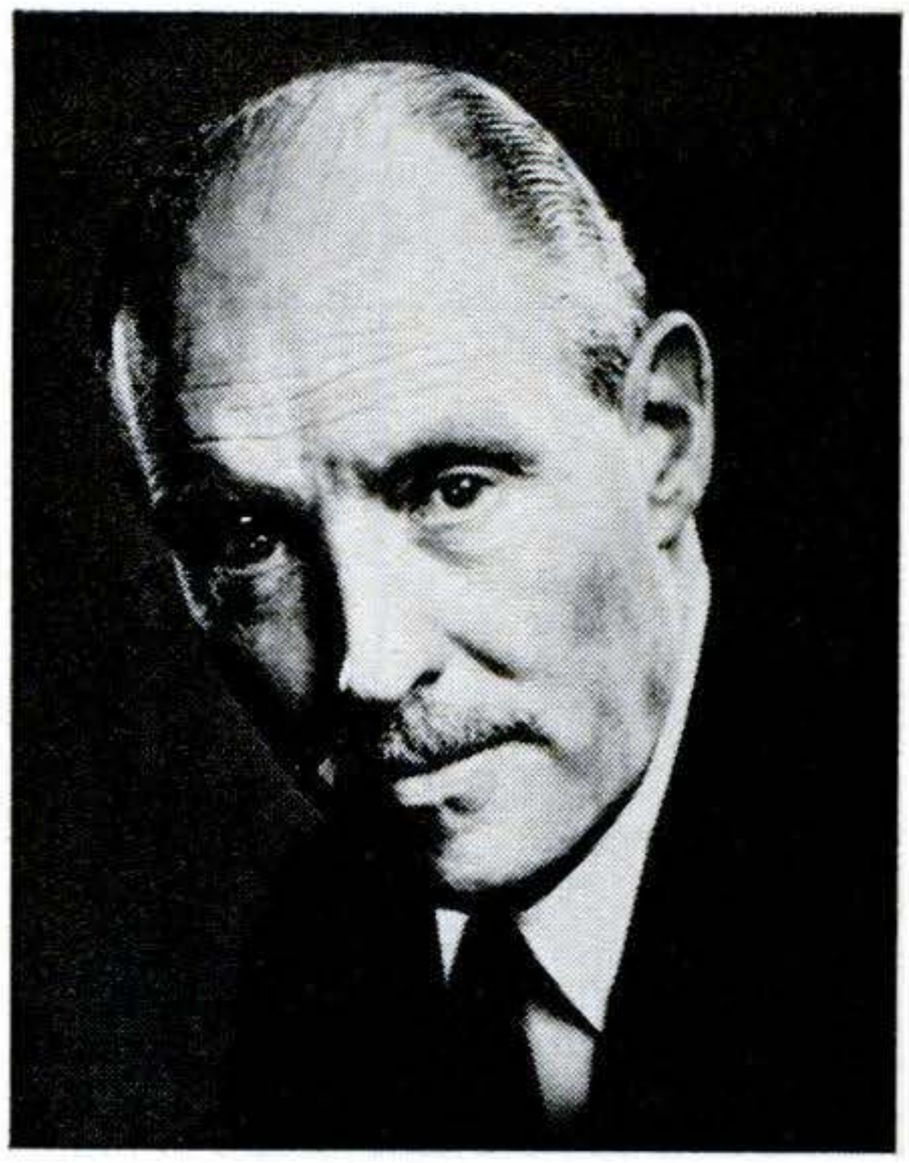
What every creative person should know about writing for money

Here are interesting facts about full-time and part-time careers in writing — and how 12 famous writers are ready to help you get started

By Gordon Carroll



Gordon Carroll is a former editor of the *Reader's Digest, Time, Inc.* and *Coronet* — and Director of the Famous Writers School.

Writing today offers a life of financial reward, personal recognition and the freedom to live as you please. But...not everyone can or should become a writer. Before you decide, here are some facts you should know.

How much can you earn?

Jobs for writers range from $6,000 to $35,000 a year, depending on ability and experience. Staff writers on magazines earn $7,000 to start. Editors with experience earn $15,000 or more. If you free-lance, you can sell your work to newspapers and magazines for fees up to $3,500. For those who reach the top, the rewards are truly substantial. Max Shulman received $250,000 for the movie rights to one of his novels. Rod Serling has a contract with a television network that runs into six figures.

Can you live an independent life?

Certainly. As a free-lance author, you can live where you want and work on any schedule that suits you. J. D. Ratcliff, a leading article writer, works in the mornings and has his afternoons to relax. You don't have to travel to work, and you can submit your stories and articles by mail.

What are your major markets?

There are 1,100 book publishers — 700 magazines — 11,000 newspapers — 12,000 trade publications — 500 radio and TV stations — 2,800 advertising agencies. All are looking for writers.

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You write at home and send your lesson assignments to the School by mail. Here, your assignments receive the personal attention of instructors who are themselves professional writers or editors. Your instructor goes over your work line by line, word by word, blue-penciling corrections right on it — much as editors do with established authors. Then he returns the corrected assignment to you with a long letter of advice on how to improve your writing.

This training works well. Our students have sold their writing to hundreds of publications.

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To find out if you have a talent for writing, mail the card for our Aptitude Test. Your test will be graded free and returned to you. If you test well, you will be eligible to enroll. But there is no obligation. (If card is missing, write to Famous Writers School, Dept. 6351, Westport, Conn. 06880. Give name, address, age and ask for writing Aptitude Test.)

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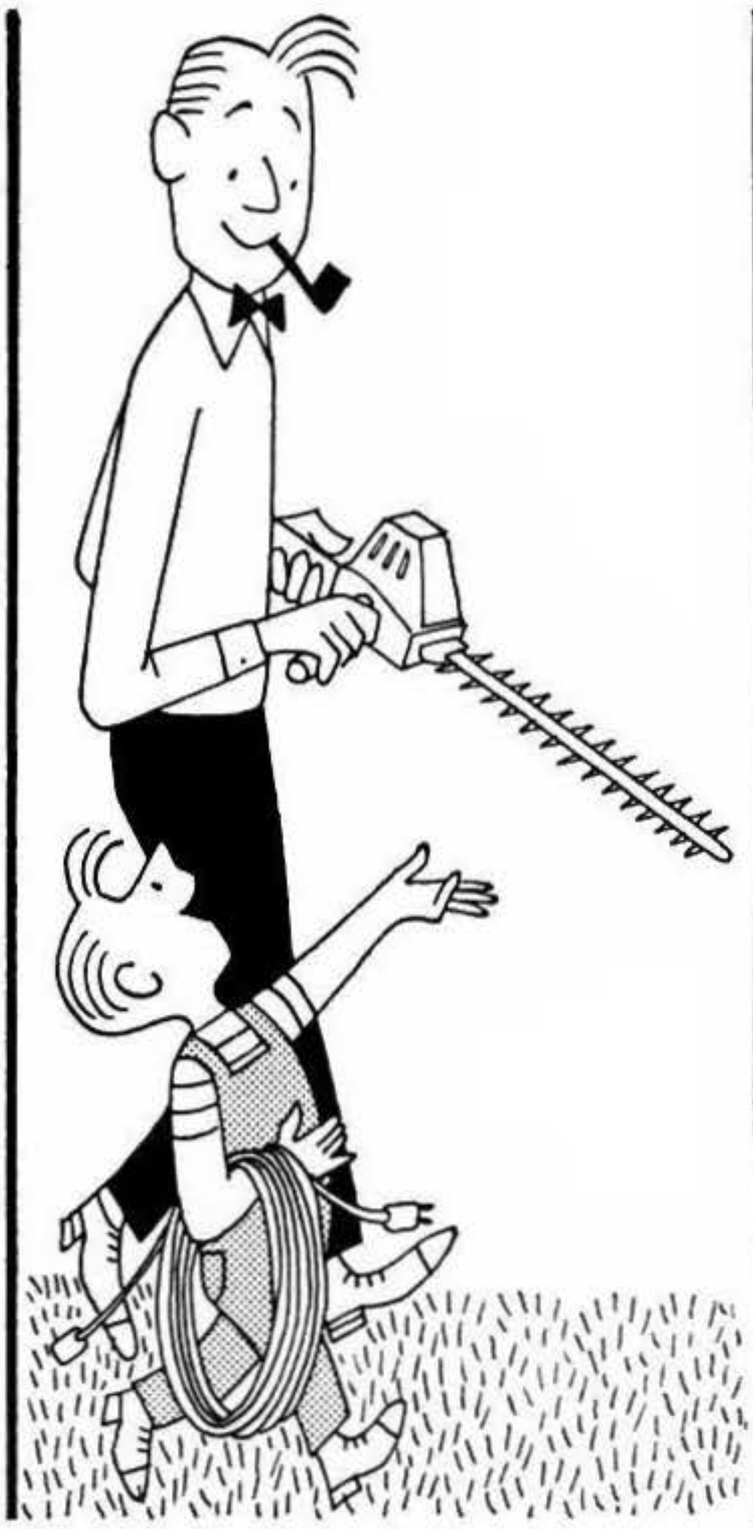
Wordless Workshop

By ROY DOTY



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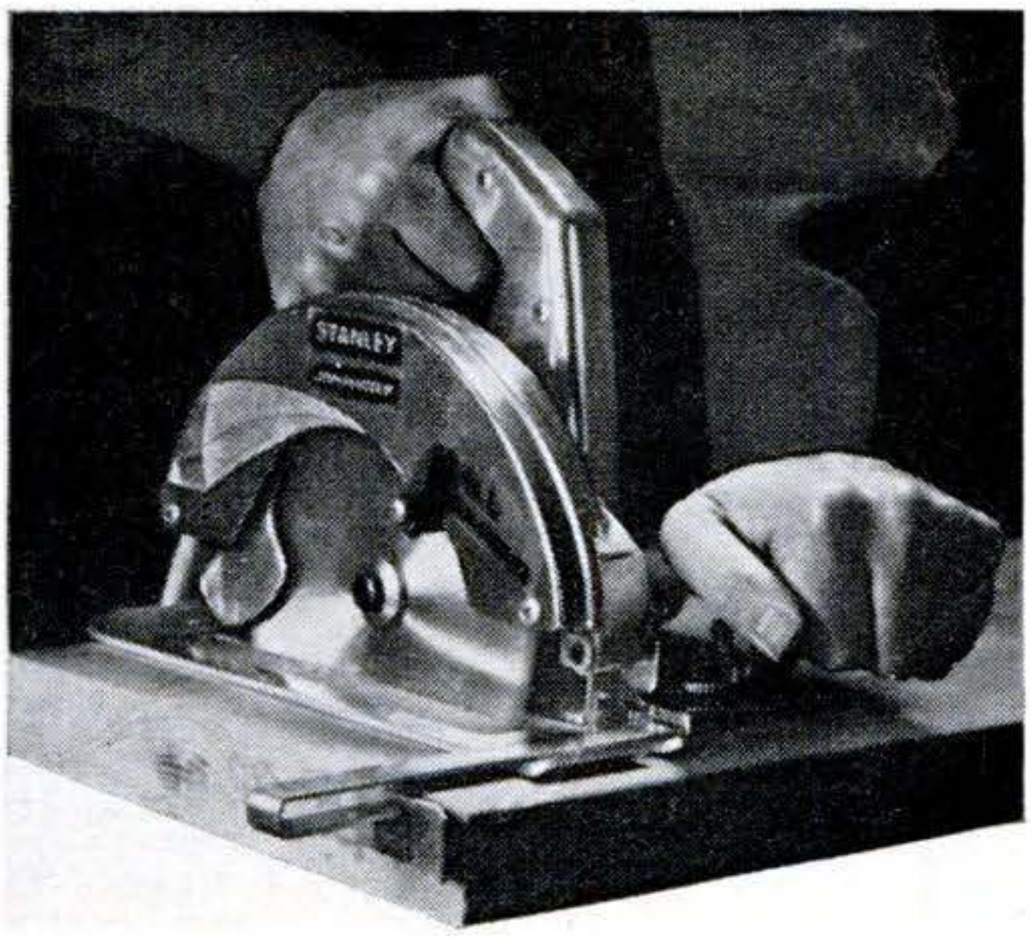
The new ¼" Reversible Speed-Control Drill is powered by Stanley's own dynamically balanced heavy-duty motor. Precision, heat-treated, cut-steel gears and three-jawed chuck permit continuous drilling. Finger-tip speed control from 0 to 2250 RPM for metal or wood drilling, polishing, sanding, or driving screws. It's reversible too. FREE, a six-inch sanding disk ($1.08 value) with each 80 742 drill. Only $29.95.

Powered by a full 2 HP Stanley motor, nothing beats Stanley's Heavy Duty 7¼" Circular Saw for professional power and cutting capacity. Ball bearing action for smooth efficient operation, with specially built-in dust chute and adjustable auxiliary handle. There's nothing easier to use. Extra combination-saw blade FREE ($3.25 value) with each 80 278 saw at $78.95.

With extra torque for tougher jobs, Stanley's ⅜" Reversible Speed-Control Drill features complete variable speed from 0-1000 RPM, permitting drilling in ceramic tile, metal, wood, or use as a power screwdriver. Powered by Stanley's own heavy duty motor, ball bearing action and two-stage gearing assure smooth, continuous, heavy-duty operation. Flip the reversing switch and the chuck rotation changes — permitting easy removal of drill bit or screws.



This Stanley Job/Master 7¼" Circular Saw cuts through a 2" x 12" fir plank in 1.3 seconds.

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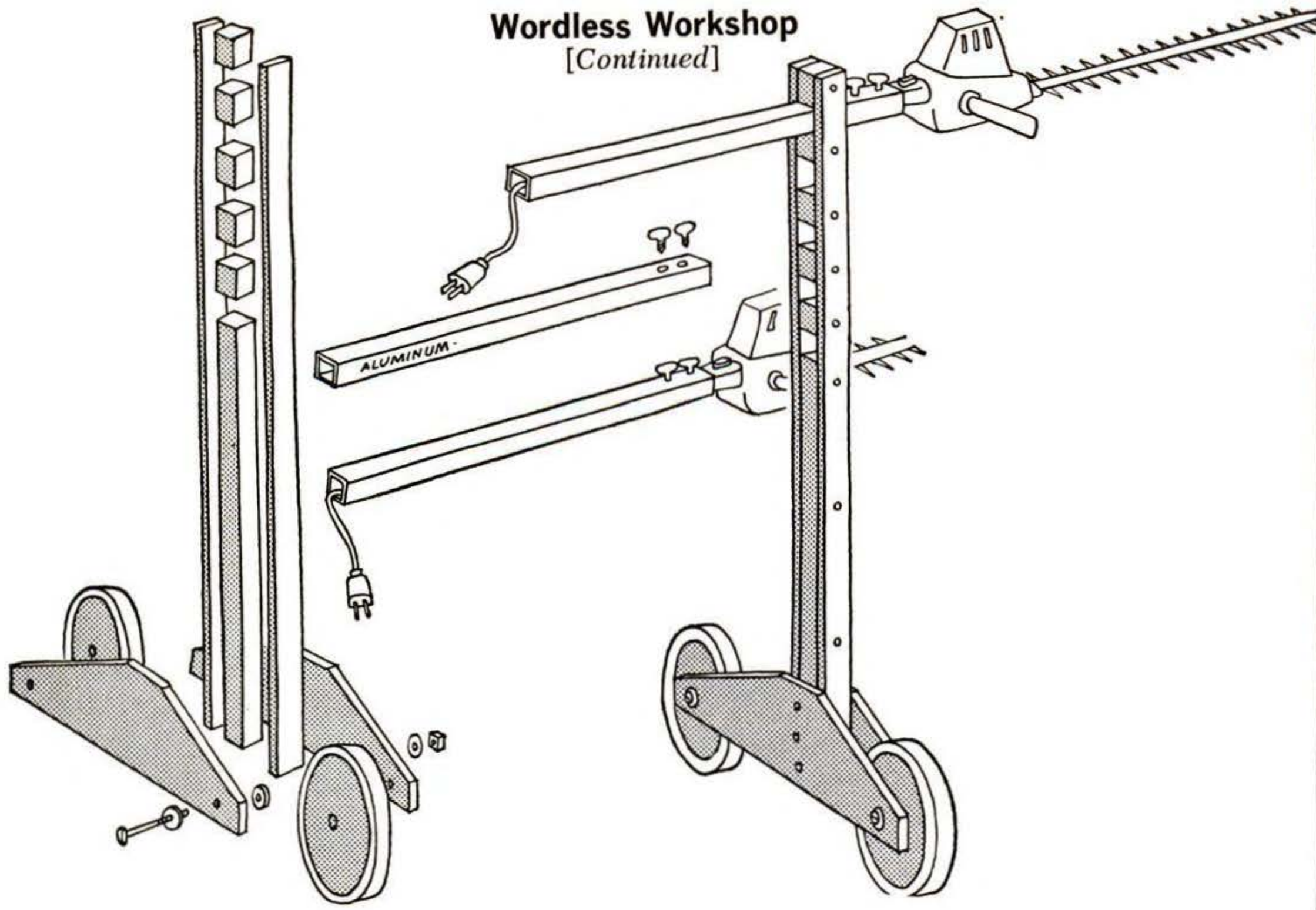
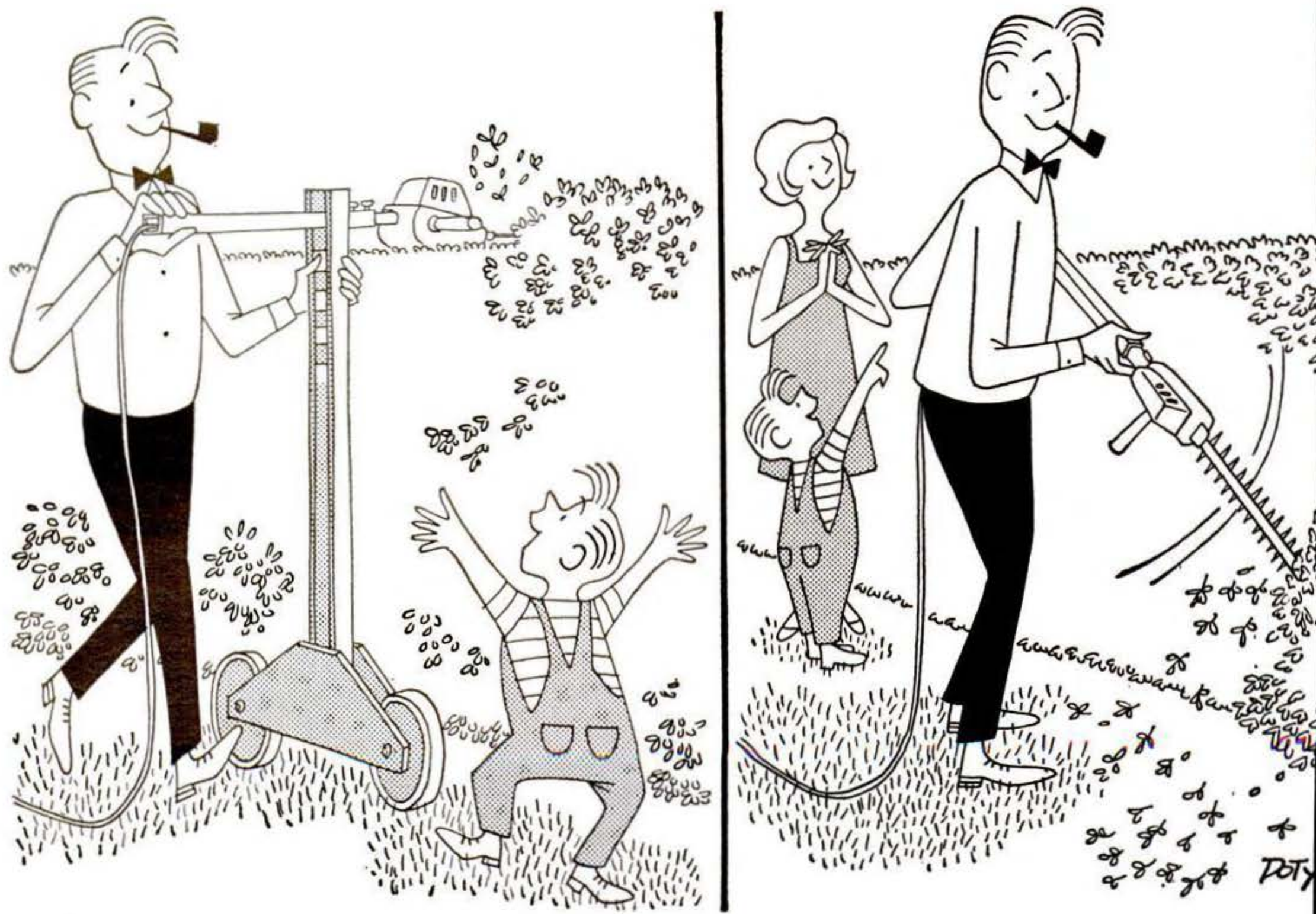
Wordless Workshop
[Continued]





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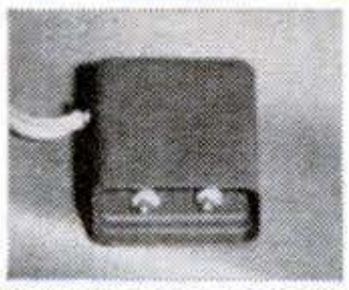

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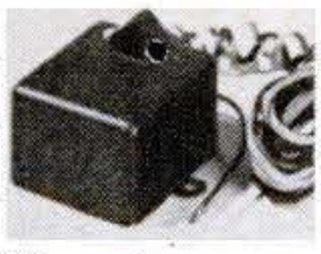

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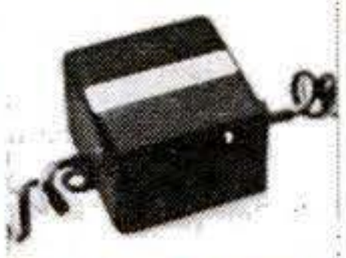

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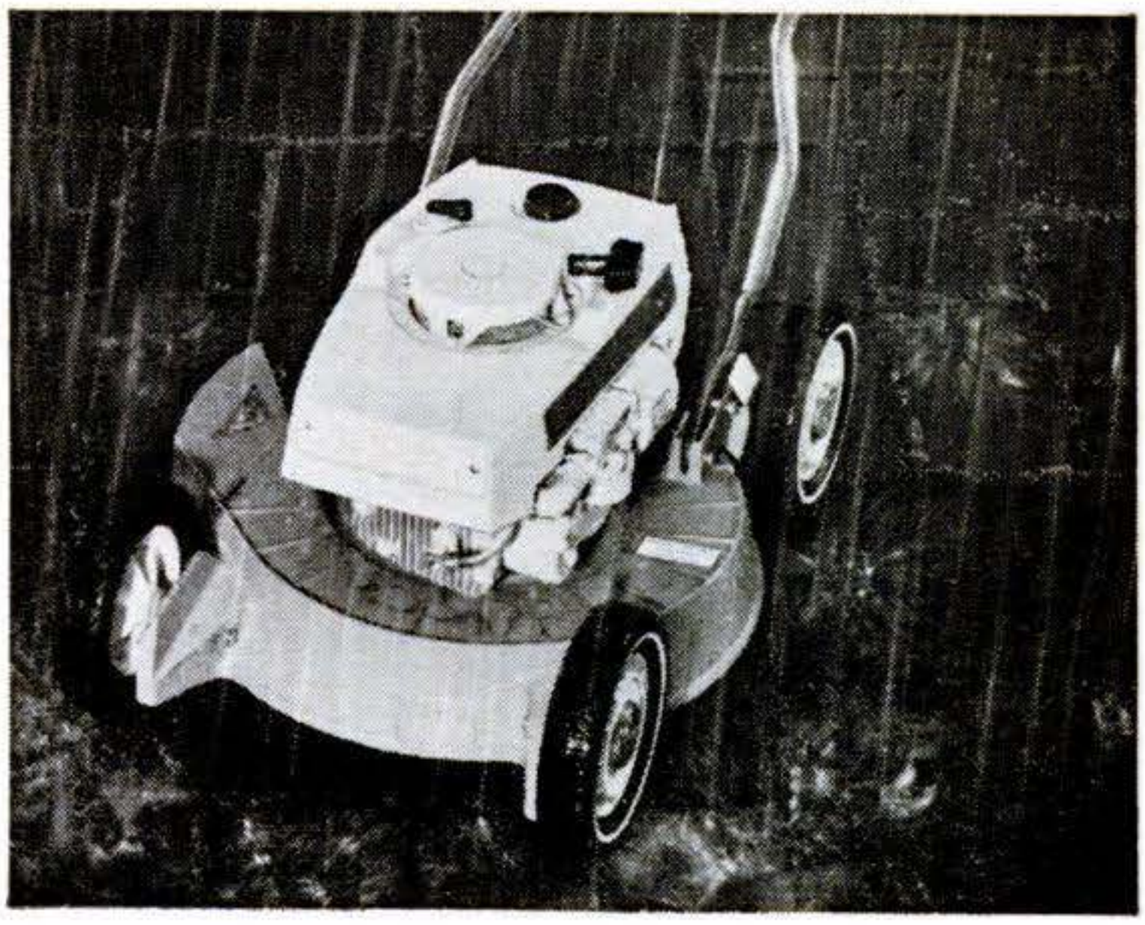

3-IN-ONE isn't.

Spray on a little 3-IN-ONE OIL regularly, and you can keep rust from getting started. Helps clean it off, too. Cuts down wear on moving parts . . . things last longer. When you spend good money on a power drill, garden tools, bike, etc. . . . shouldn't you spend a few cents to protect them? Regular. Electric motor oil. Or this handy new spray can. 3-IN-ONE . . . it's wise insurance.

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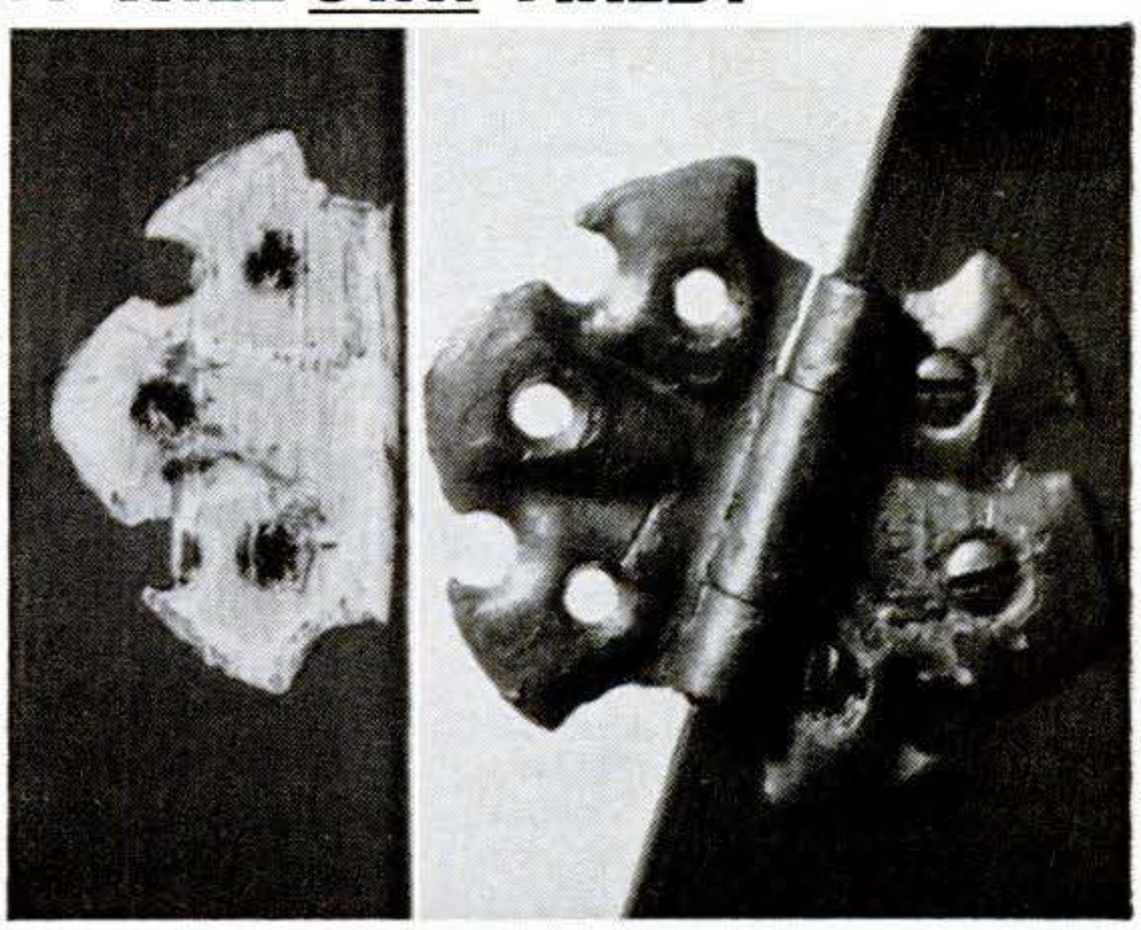

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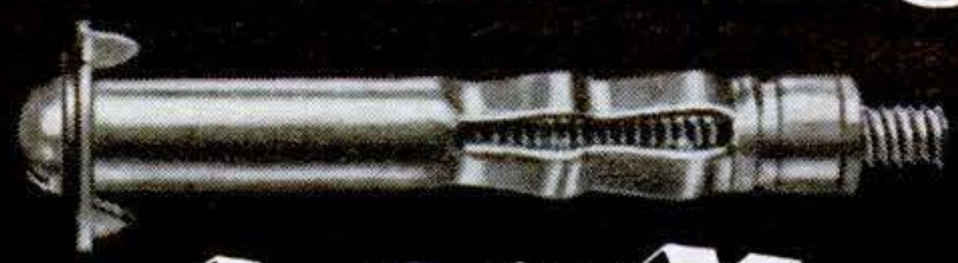

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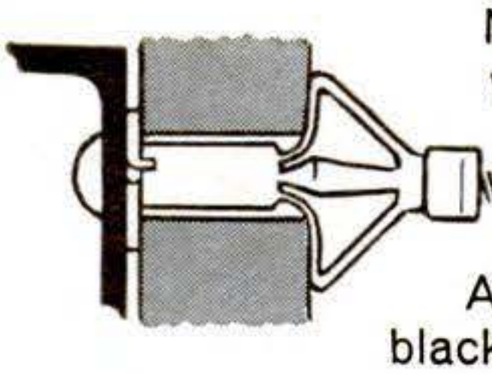

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I "Drove" Through a Town That Isn't

[Continued from page 79]

vice would like to know what those drugs are and give the information to physicians and the public.

What physical disabilities affect driving? How about aged drivers?

"We intend to work with people in these categories to see exactly what they can and can't do behind the wheel," McKelvey continued. "We'd like to know how drivers react in a crisis, how far you can drive without getting too tired to do a good job, and what happens when we distract a driver. We want to find out whether driver training really does make better drivers and whether it might be possible to rehabilitate poor drivers."

One important point that McKelvey and other authorities on automobile safety have made time and time again is that while we can improve driving skills, we have thus far had little success in improving driver attitudes.

"Here's a chance to try something new," says McKelvey. "With simulators we can create crises—traumatic situations that will help a driver understand the consequences his driving might have in a real situation."

In other words, simulators let you live through an accident and become a better driver because of it.

How they work. Want to simulate a long trip? This is best done with the belt simulator—the machine I drove first. It has five moving belts running in an endless loop 35 feet long. As you press the accelerator, the center belt, painted with highway dividing lines, and the two side belts containing trees, shrubs, signs, and other scenery, speed up, giving a perfect illusion of motion.

Adding to the illusion is the lateral motion of your car: It is mounted on a movable steel frame, and an electric motor makes it drift laterally. The wind blowing in your window is real—but it's provided by a fan. A hood covers the car, and illuminated "window boxes" at sides and rear suggest scenery.

Flicking the ignition brings to life the "engine" (a multitrack tape recorder connected to a speaker on the firewall) Flooring the accelerator races the "engine" and vibrates the car realistically.

You see a car traveling ahead of you:

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I "Drove" Through a Town That Isn't

Actually it is fixed in place on the right-lane belt and, depending on its simulated speed (decided by the operator), the belt moves toward you or slowly away. As you swing around it, you move the lens projection system over to the left-lane belt, which moves toward you carrying opposing traffic.

At a computerized console outside your car, the operator reads your speed, the speed of the car ahead, and the speed of opposing traffic from three large speedometers. He adjusts lighting on the belts (60,000 watts' worth of mercury and fluorescent lamps) and the lights on the model cars to create daylight, twilight, or night driving conditions. Other meters show the simulated distance between your car and the models, from 750 feet down to zero.

As you drive, electrodes measure your respiration, heart rate, blood pressure, and skin resistance, while a pen-recorder squiggles down each variation. The car itself measures reaction time: the time it takes you to lift your foot from the accelerator in an emergency. This data is flashed to a timer and recorded.

Driving by TV. If you want to sample every driving condition and hazard of the road, the TV simulator is equipped for it. The driver of the car actually "drives" a motorized TV camera that follows every steering-wheel variation and speeds up, slows down, or stops, in response to brake and accelerator signals.

Weirdly convincing, the TV image you see is reflected by a concave spherical mirror. You look at objects within its focal point, and the image you see is a *virtual image* that appears to be 50 feet beyond your windshield.

Car, light poles, and other realistic details line the streets, and moving traffic (in reality, slot cars) comes toward you and disappears. A tiny HO-gauge train looms large as life as it crosses on rails in front of you.

The work of the Driving Research Laboratory is serious business, but I had a few moments of pure fun. After test-driving the simulator, I got a little recklessness out of my own system. Where else could you drive through a lake, over a mountain, and right up onto the front porch of a farmhouse? PS

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Breakthrough! Foolproof Water Paints

[Continued from page 110]

or Liquid Sandpaper. You can't expect any latex paint (or oil paint, either) to stick to a dirty surface or to waxes and oils. So clean surfaces first.

- Paint *wet*. Carry a lot of paint to the surface, and brush it out only far enough to avoid puddles on flats or dribbles on verticals. Although brush drag is built in, to discourage overspreading, latex enamels are still so easy to handle that you can easily brush out too much. Coverage figures on the can—usually 400-450 square feet to the gallon—are intended as the *maximum* beyond which you must not go, or the coating will be too thin.
- The best application technique is to lay on a brushload along the wet edge, then brush it out into the new area and blend it back into the previously painted area. Don't try to go back and pick up skips with latex enamel; it doesn't work the way it does with flat wall paints. In other words, paint carefully.
- When two coats are necessary, give the first plenty of drying time. Some labels say two hours. This is probably not enough for a good job. Other makers ask for overnight drying. Since it is generally recommended that you sand lightly between coats, you have a good drying time-check: If the sandpaper clogs unduly, it's a sign the coat is not dry enough for ideal recoating.

Where does it go? Any place indoors. A paint chemist told me you could use it in a shower stall. Doors, woodwork, trim, banister, baluster, closet interiors, kitchen walls and ceilings, shelves, wood paneling, basement rooms—all these and more are ideal for latex enamel. It is not recommended for furniture (or any other use that is patently a glossy-enamel situation) but I have had excellent success with it on work surfaces that need not be kept bright and clean looking.

One of the meanest tests I gave latex enamel was on window sills and sash, where temperature differences, moisture from condensation, bright sunlight, and other tortures are extremely hard on enamels. The latex material—probably because it tends to stay flexible and doesn't chip—outlasted the best grades of alkyd, oil-based enamel. PS

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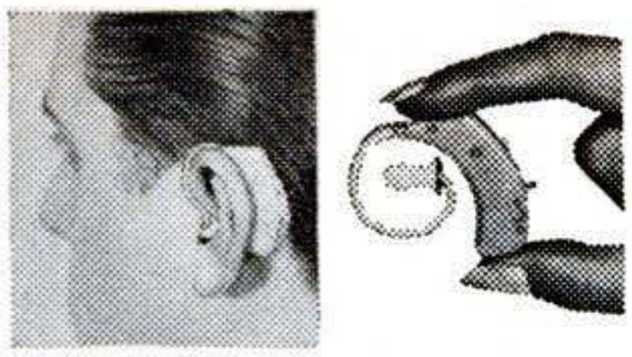

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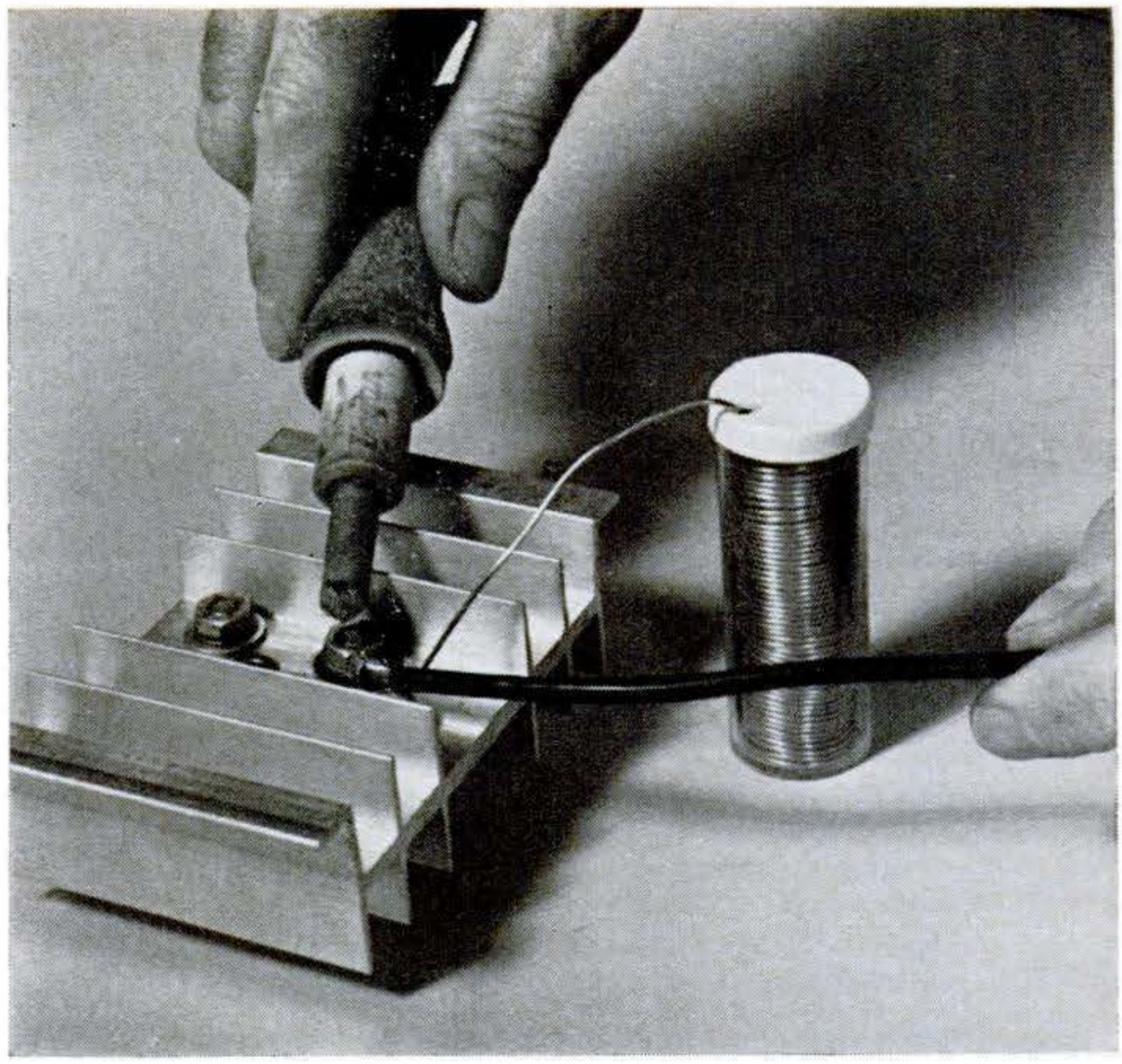
SHORT CUTS AND TIPS

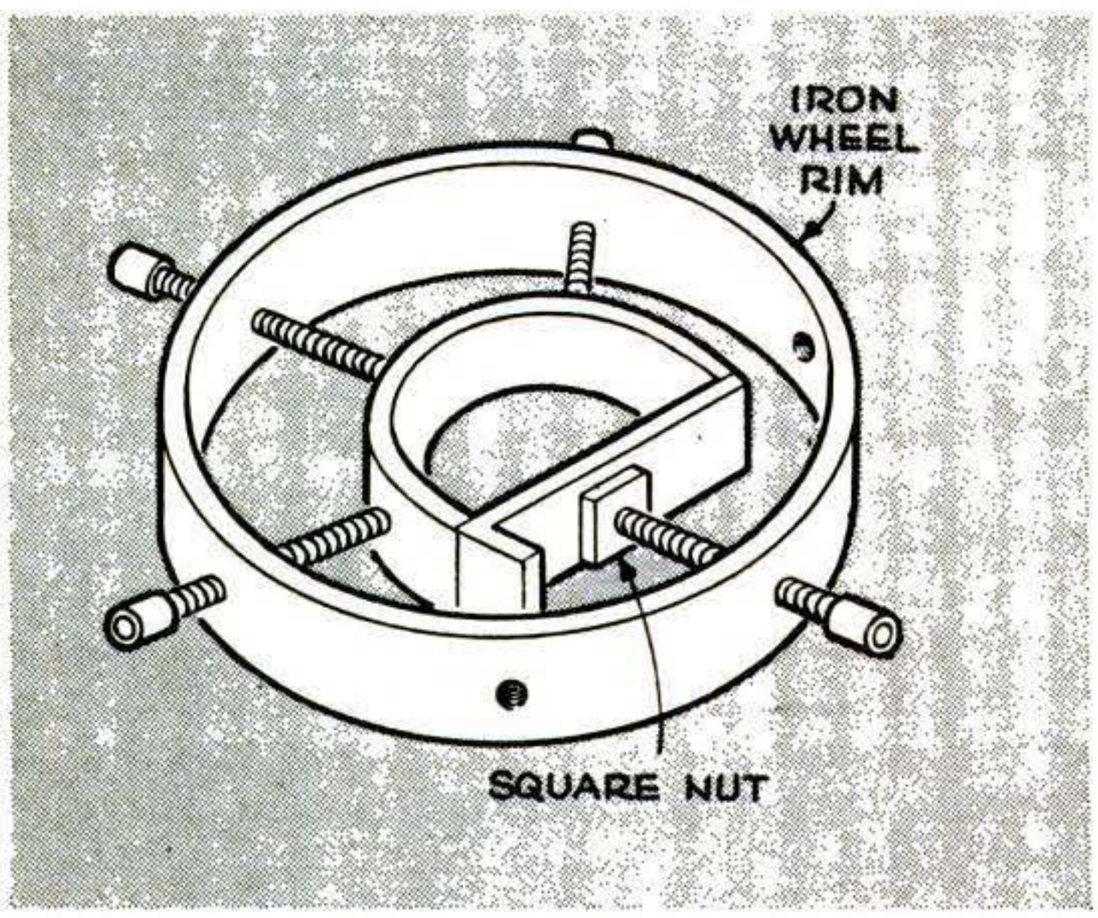
FROM PS READERS

Pill bottle makes a simple, handy solder dispenser

If you've ever felt the need of a third hand when soldering, this solder dispenser will help you. It's simply an ordinary plastic pill bottle with a ⅛" hole drilled in the cap near the edge. Wind a length of .062" resin-core solder on a length of dowel, drop it in the bottle, and snap the cap in place with the end of the coil through the hole. Pull the solder out as you need it and bend it to position.

FRANK GREENWALD
Western Springs, Ill.

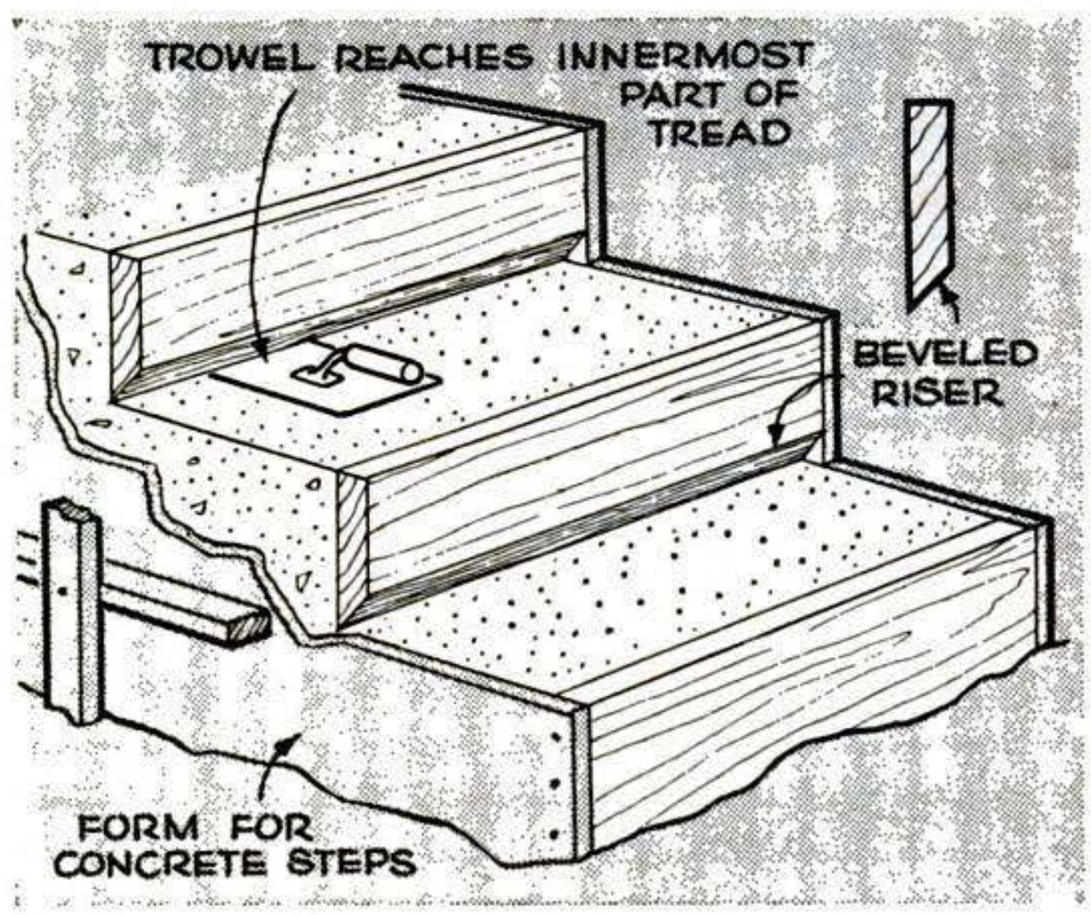




A vise for welding odd jobs

Holding odd-shaped pieces together for welding is a cinch if you have a vise like one I own. I made it from the rim of an old cast-iron pulley. I sawed out the hub and spokes, then tapped six evenly spaced holes through the rim. Full-threaded bolts through these hold the work. If you screw nuts onto the ends of the bolts, you'll get a better grip on flat surfaces.

PETER LEGON, Malden, Mass.



Beveled riser form for concrete steps

If you're planning to build some concrete steps, take a tip from me and you'll do a better job. Bevel the riser forms as shown in the drawing above. Ordinary square-edge riser forms leave rough spots which cannot be reached with the trowel. With beveled forms, the trowel gets underneath between riser and tread, troweling is easier, and rough spots are eliminated.

VICTOR H. LAMOY, Upper Jay, N.Y.

Handy shims kept ready to hand

I never run short of shims of various thicknesses since I thought of buzzing up a supply in advance out of a few feet of two-by-four. They're invaluable time-savers when you're framing up partitions or installing panels.

JAMES KELLY, Kings Park, N.Y.

Small drum sanders you can make

In my cabinet work, I find many uses for small drum sanders. I make them up from drill rod, and set a screw in one end with the head ground off. Sandpaper is cemented on with disk cement. I use the drums in a ¼" drill.

J. MACCAUGHAN, Bradenton, Fla.

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Do You Need a Lawn Edger?

[Continued from page 126]

lawn. Tailor your choice wisely to the job.

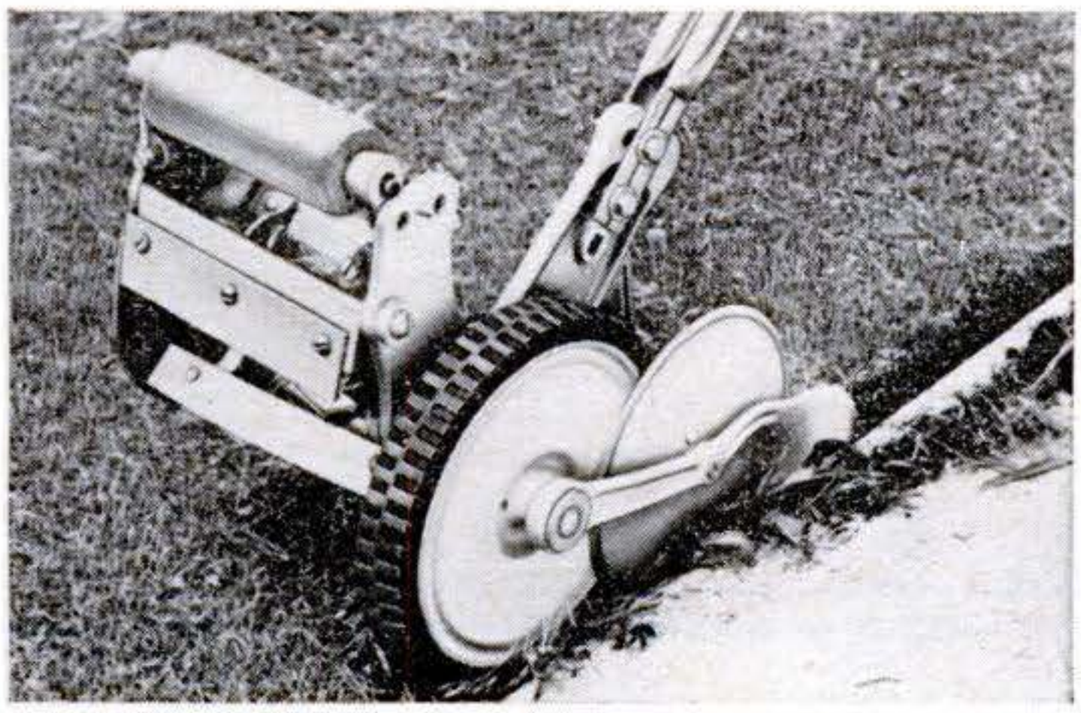
One thing to bear in mind: The blades on most of these machines have fairly small guards. They are designed to deflect dirt and stones, throwing them ahead of you. Keep children and pets out of the area where you're working. If you have to leave the handle to make any sort of adjustment, manufacturers advise unplugging the electrics and detaching the spark-plug leads on gas models.

Exceptions in the matter of skimpy guards are Black & Decker's two electric models. They have extensive housings surrounding the blade, and in addition are equipped with a shoe, along which the unit slides when trimming.

Many manufacturers of electric units advise against their use under damp conditions and recommend that you wear gloves. Rockwell, however, claims that their models are virtually shockproof. They cite extensive use of nonconducting materials within the motor itself, as well as motor housings of high-impact plastic to seal off any possibility of transmitting current to the operator.

Here are some features to look for when buying an edger-trimmer:

- A blade clutch lever to halt blade rotation without stopping the motor.
- Wheels adjustable vertically and horizontally. This gives you maximum maneuverability—often helpful, as when a walk is higher or lower than the lawn.
- All controls on the handle for greater ease of operation and safety.
- On electric models, a slip clutch to prevent overload.
- A multiposition tilt on the cutter head for greater flexibility. PS



Hand edgers are still with us, too. This one from Pennsylvania Lawn Products flips over for trimming.

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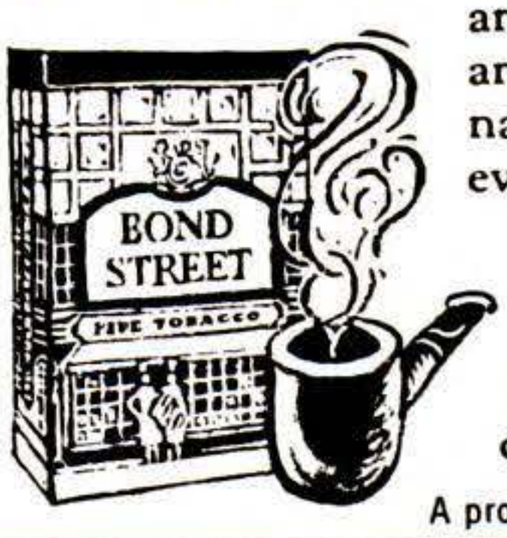

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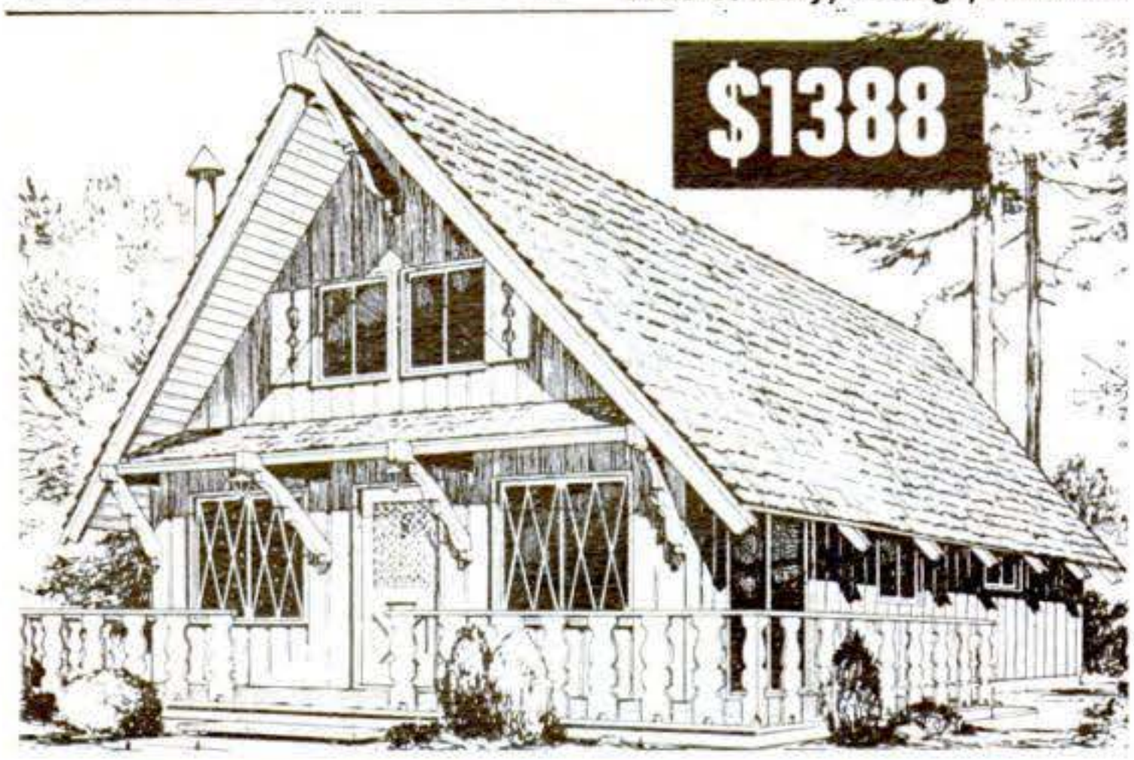

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Medical Miracles in South Vietnam

[*Continued from page 73*]

ment Laboratory at Fort Totten, in New York City.

Among current projects is a portable machine to take plastic blanks and grind eyeglass prescriptions right on the battlefield. Another is a lightweight system for manufacturing sterile water, eliminating the need to ship it in.

In conjunction with GE, Fort Totten labs are developing lightweight plastic surgical instruments to replace conventional stainless-steel tools. Using plastic should reduce cost, weight, and light reflection.

Helicopter ambulances. The omnipresent helicopter is perhaps the biggest medical miracle in Vietnam. Helicopter ambulances, known as Dust-Off units from their radio call sign, evacuate 90 percent of the wounded.

Time is all important in Vietnam. Roads are rare and seldom secure. Turbine-powered Bell UH-1B and UG-1D Huey helicopters are a vital key to getting the wounded from where they are hit to hospitals where they can be treated. The faster a man can reach surgery, the faster shock and infection is curbed. Chances of living are multiplied.

Flying Dust-Off choppers, which carry from four to nine wounded, is a perilous assignment. Geneva convention rules call for large red crosses on the sides, nose, and bottom of the helicopters. In Vietnam, only a small red cross is left on the nose. The others are painted out. "The Vietcong use them for targets," explain the medics.

Like all helicopters in Vietnam, the aerial ambulances have metal skids instead of wheels. There is heavy armor plating on the pilot's seats, cockpit doors, and on the floor of the cabin. The pilots and crew chief are armed. They fire, however, only in defense of their patients.

In a war where courage is commonplace, Dust-Off crews are the hero's heroes. Half earn Purple Hearts during their one-year tour of duty. Ten percent are killed. Flights are made by day and night. Landings and evacuations under heavy enemy fire are routine.

"Those guys add starch to our spines," one paratrooper said. "They're the gamest of all." PS

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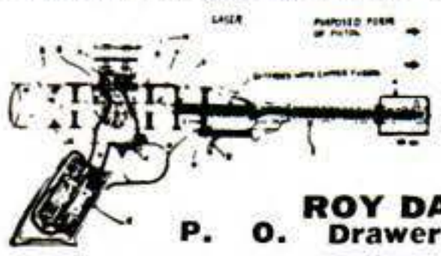

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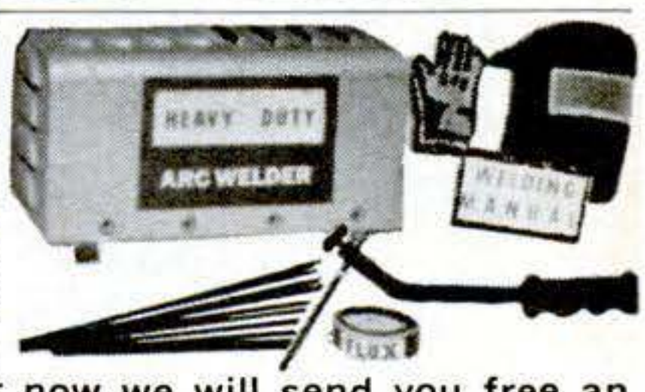

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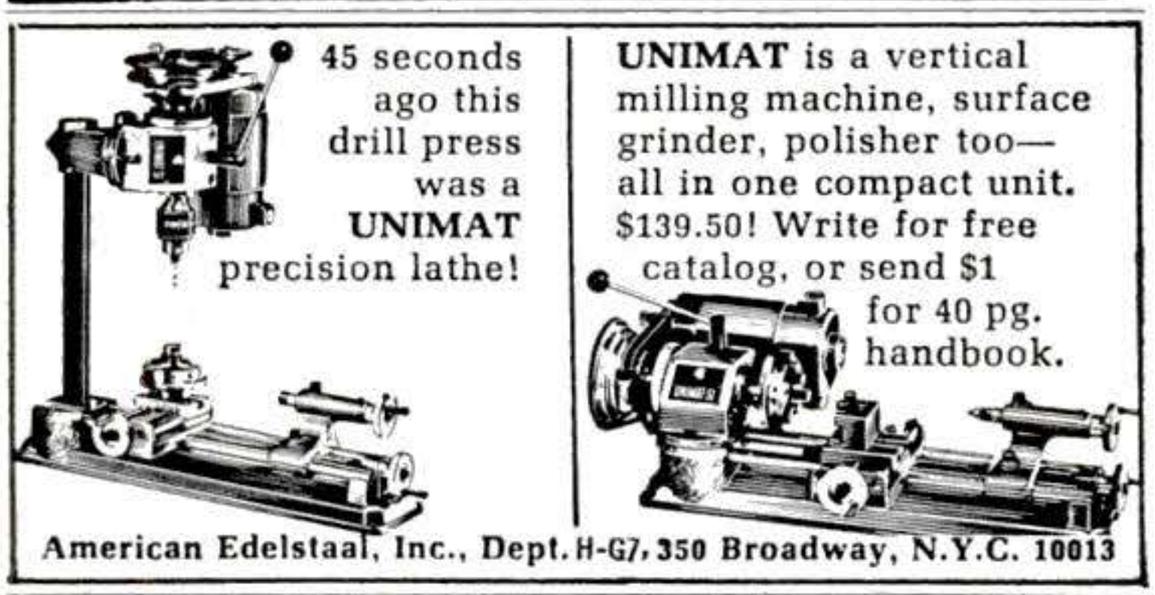

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Surprising New Facts About Muscles

[*Continued from page 57*]

sometimes even making you pass out.

By tapering off, you prevent this—and there's evidence, too, that with a gradual slowdown you're less likely to get stiff.

What causes cramps? Muscles can give rise to a variety of problems. Some are well known—like the cramp you get when a muscle contracts and stays contracted instead of relaxing. Often, this is the result of hard exercise, fatigue, or cold. It can be painful yet is usually easy enough to get rid of—by rubbing the muscle or by working the limb.

There's also muscle strain—stretching, sometimes even partial tearing, of the fibers. Most commonly, this happens in back muscles—very often because of improper lifting. Rest and warm wet towels often help.

But lately investigators have been tracing some previously mysterious problems to muscles.

U.S. physicians have been pinning the blame for many painful disturbances on "trigger points" in muscles. These are little tender areas that develop in weak muscles when they are placed under strain. But the trigger points remain after the strain is over—and they may start up pain and even shoot it out to distant areas.

Dr. Hans Kraus of New York University reports that many backaches—including some that seem to come from spinal disk conditions—may really be the result of trigger points.

Trigger-point treatment. It takes an experienced physician to find a trigger point, particularly when it's far removed from the site where the pain is. But a program of exercise to strengthen deficient muscles can lead to permanent relief. "This treatment," says Dr. Kraus, "may save disability and make braces, or even surgery, unnecessary."

In a way, it's ironical. We live in an age that makes it less and less necessary, theoretically, to move a muscle. That's the work of science. But at the same time science is showing that muscles, which make up about 45 percent of the human body, need moving and proper care—or they can kick up a lot of trouble. Give your muscles that care and you'll feel like flying. PS

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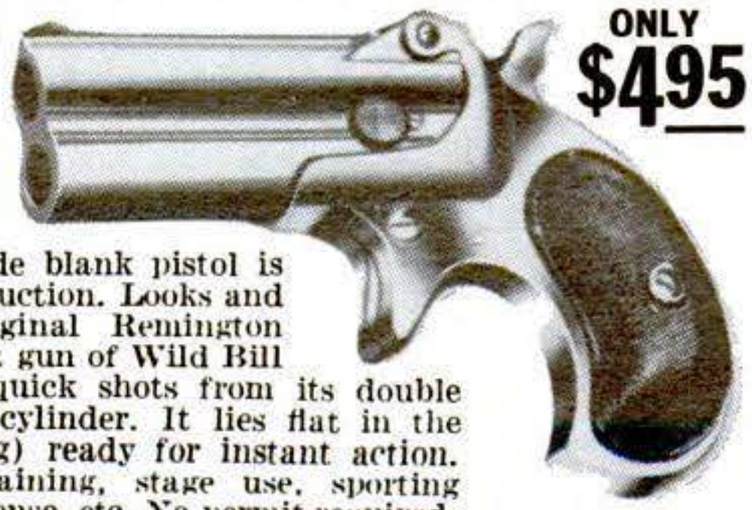

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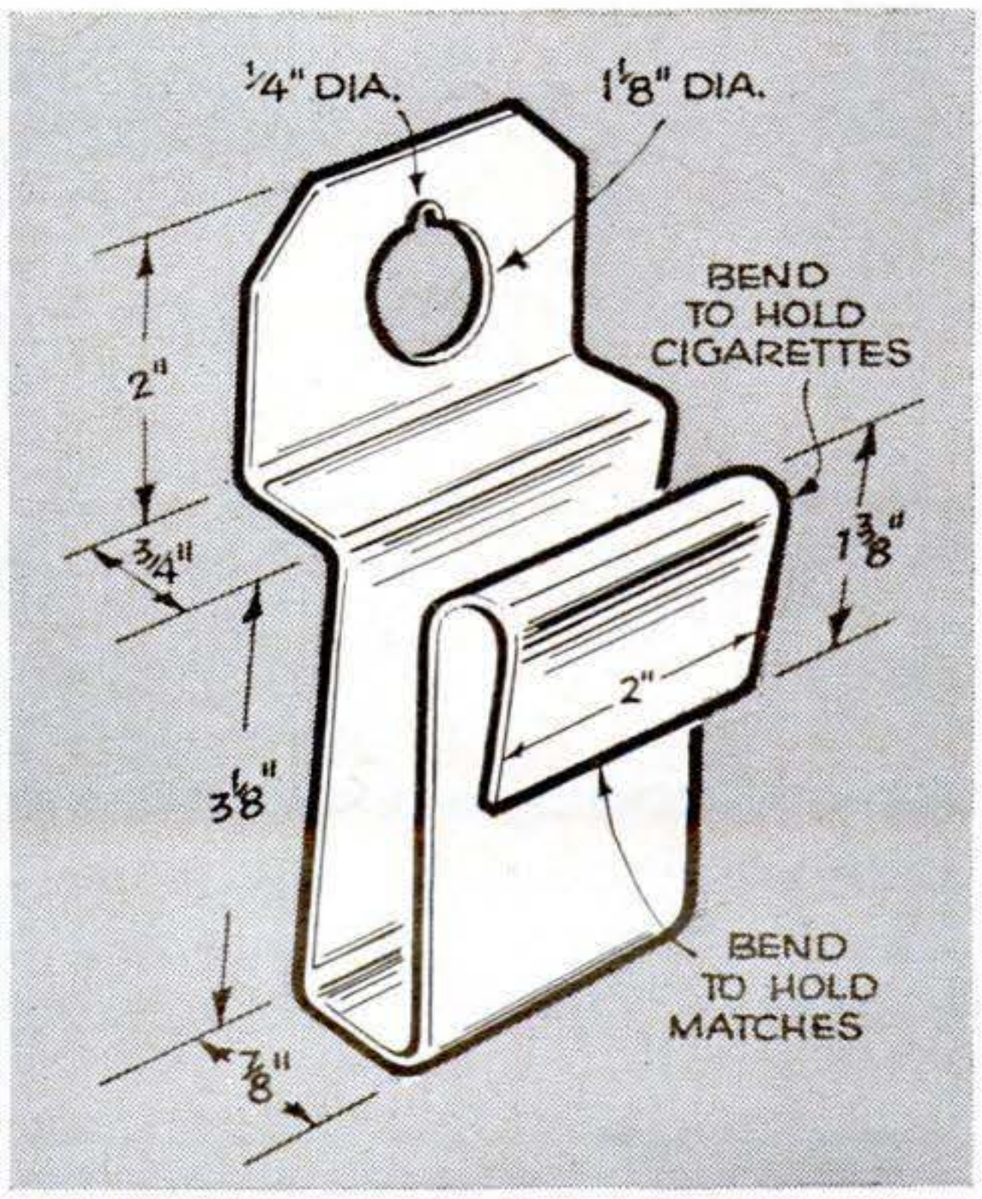
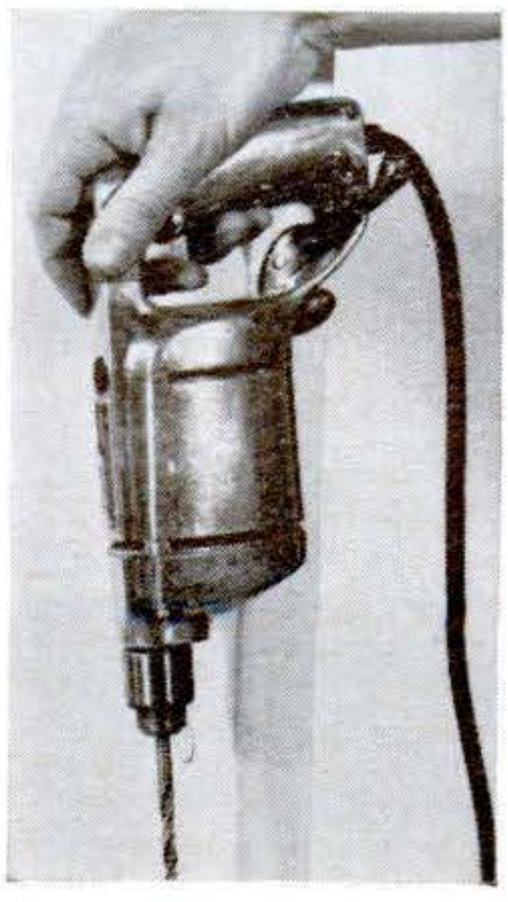


Plastic holder keeps cigarettes handy

Cigarettes and matches are always handy if you keep them in this holder. It hangs on any convenient knob in your car or shop. It's made from a 2"-by-11¼" strip of 1/16" acrylic plastic. The bends are made by heating. I used a hot plate with two pieces of asbestos shingle to provide an adjustable gap. Make the match-holder bend first. Arrange the shingles and plastic so a ½"-wide strip is exposed to the heat. When the plastic is soft, bend it around a 5/16"-diameter dowel. The other bends call for 3/16" gaps and a wood block.

EUGENE E. FLORIDA, Florissant, Mo.

Handy hanger for electric drills



Many electric drills have too wide a handle for hooks that will accommodate most other tools. I use a regular two-prong coat hook mounted in an offset position so that the lower prong keeps the drill in a vertical position.

KEN PATTERSON
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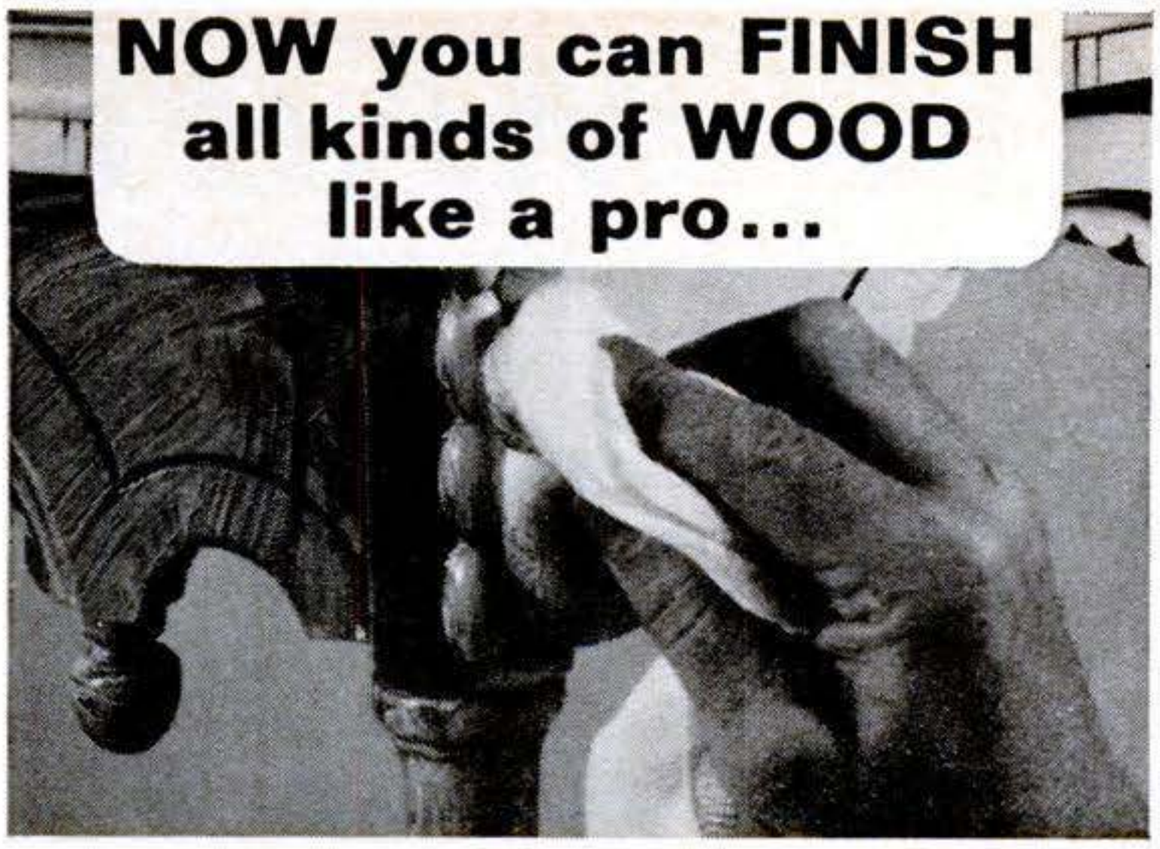

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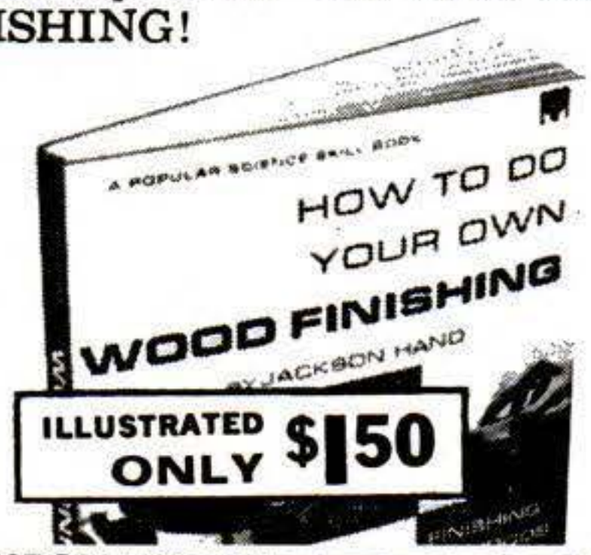

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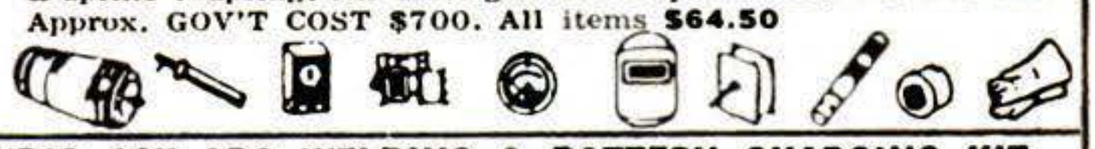

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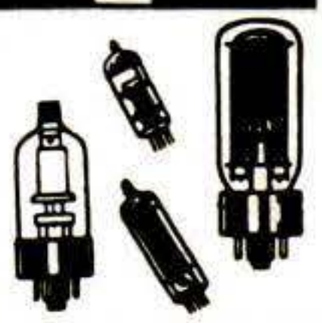

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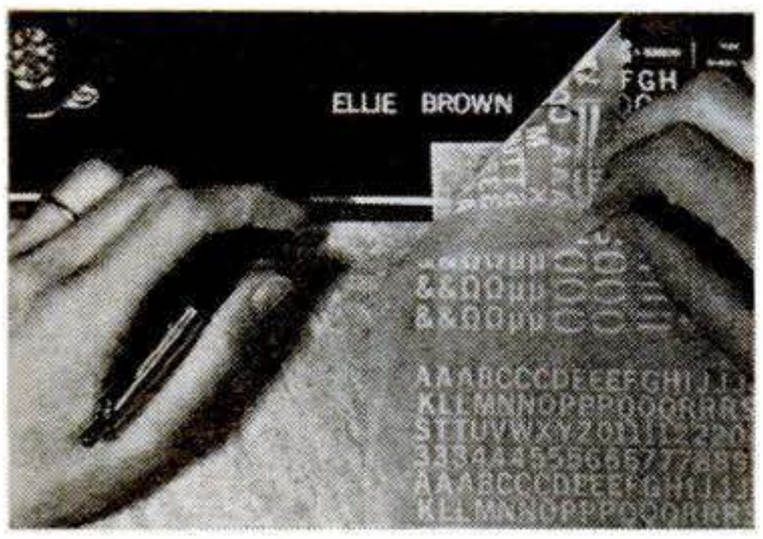

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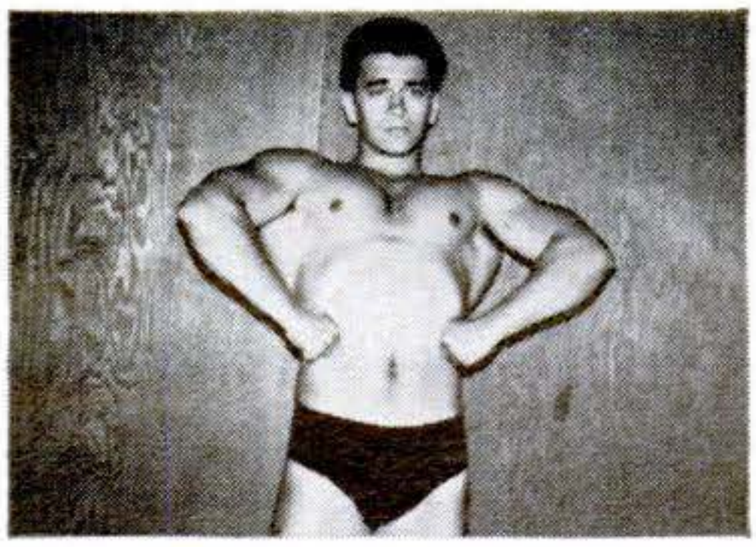

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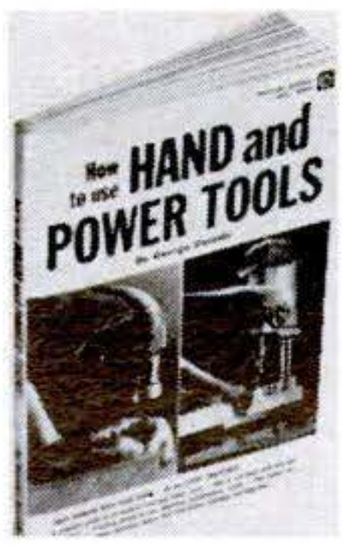

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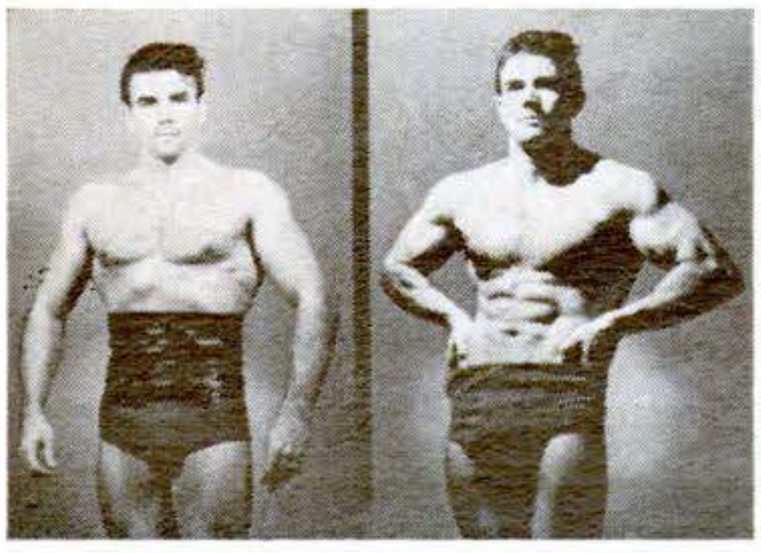

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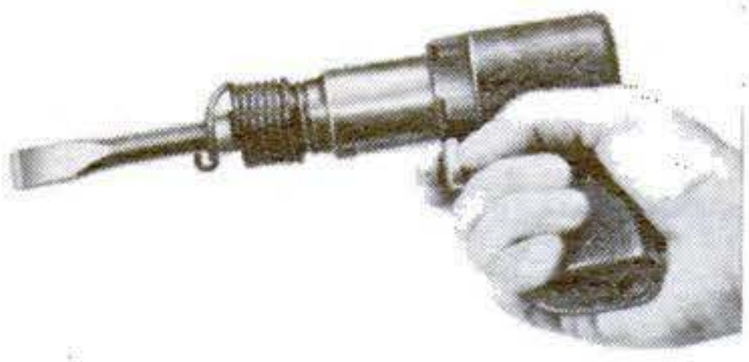

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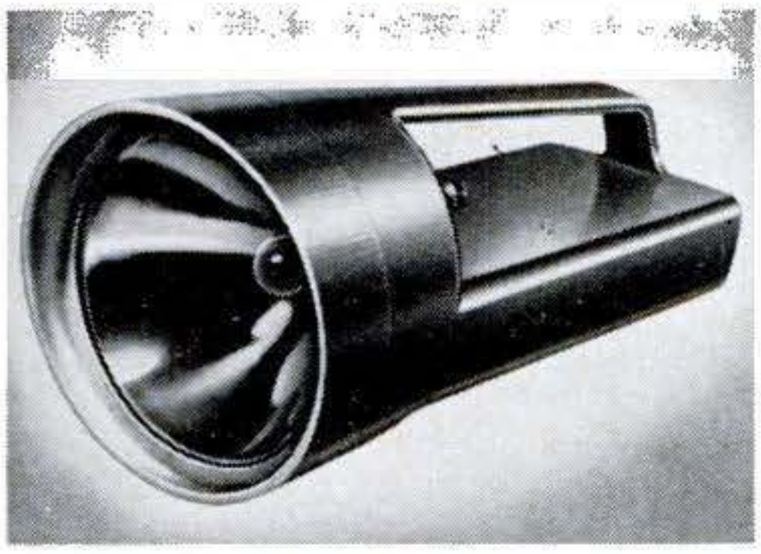

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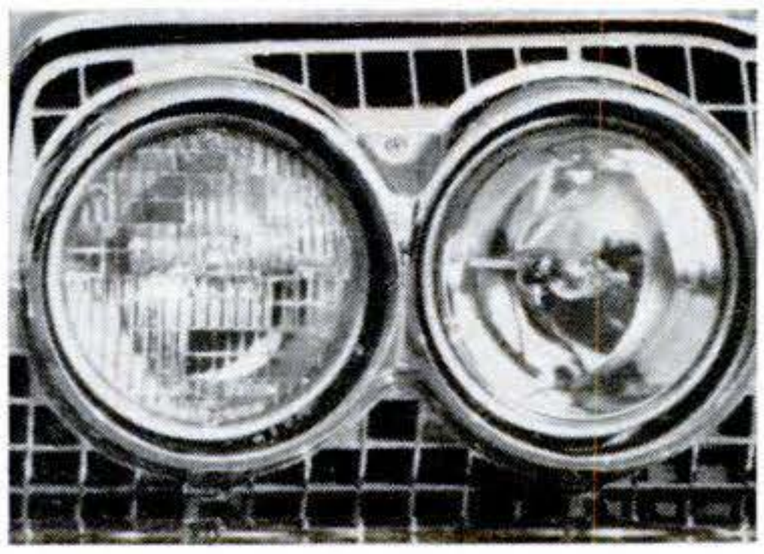

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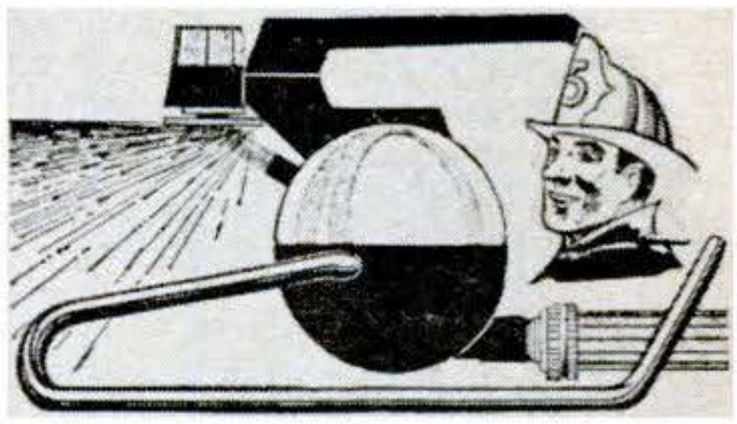

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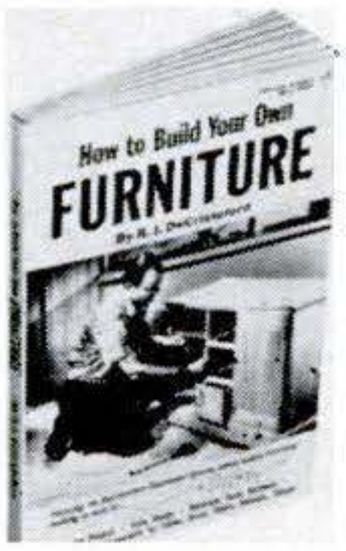

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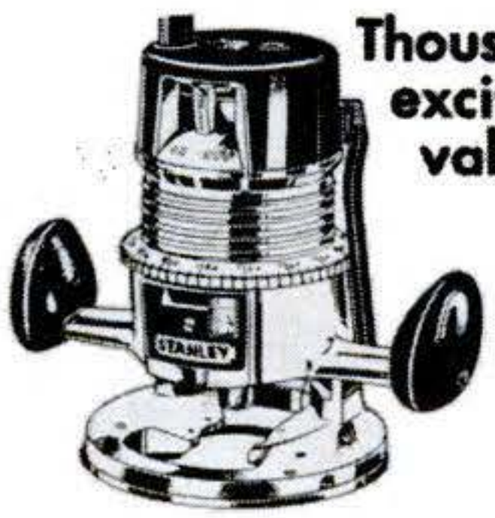

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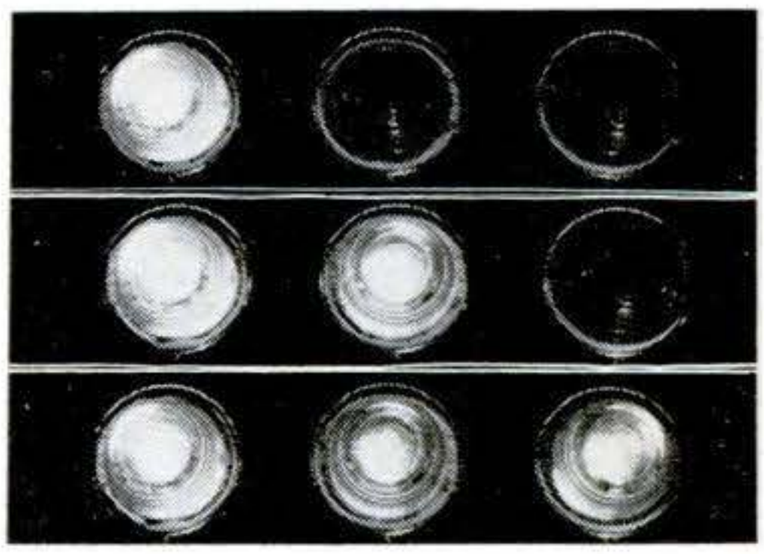

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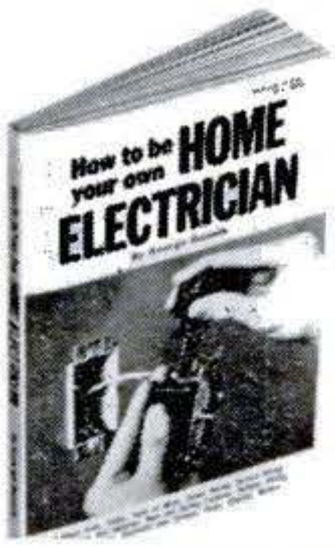

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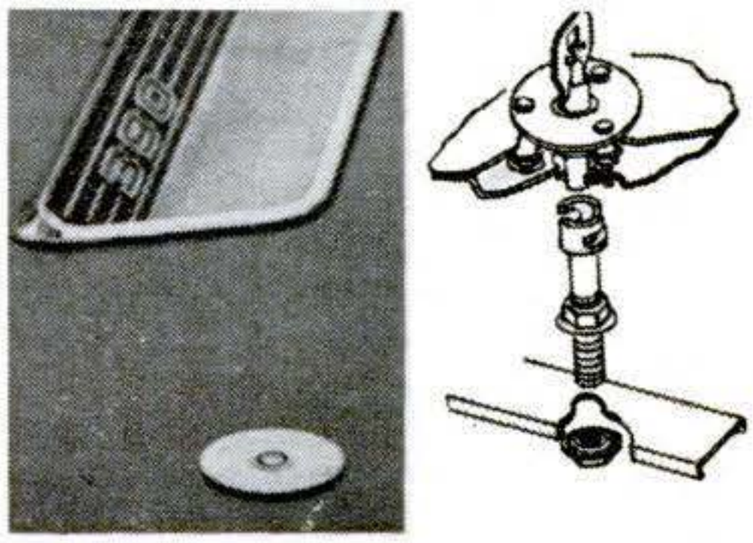

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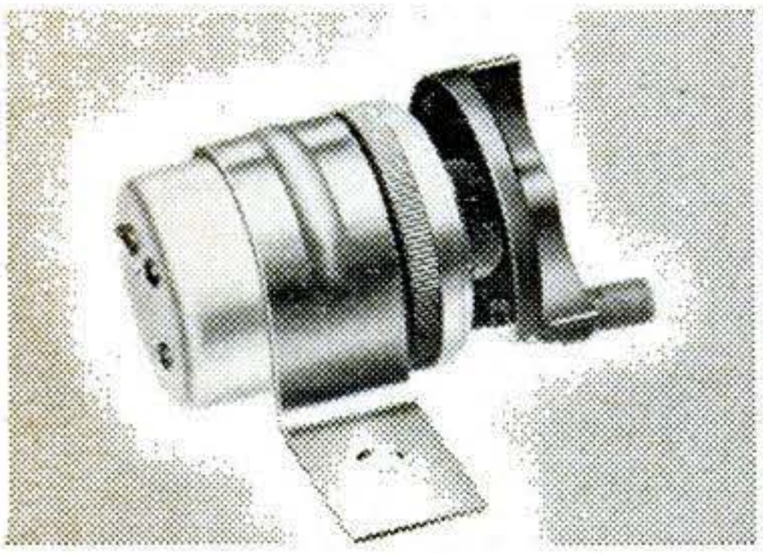

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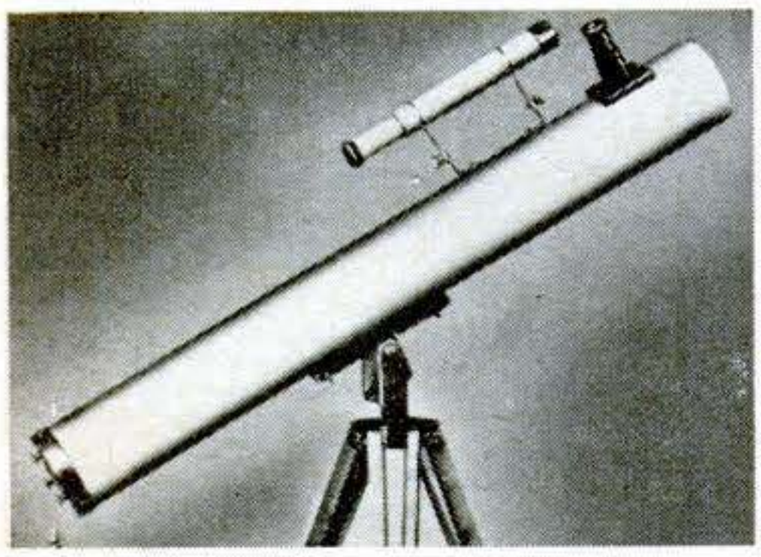

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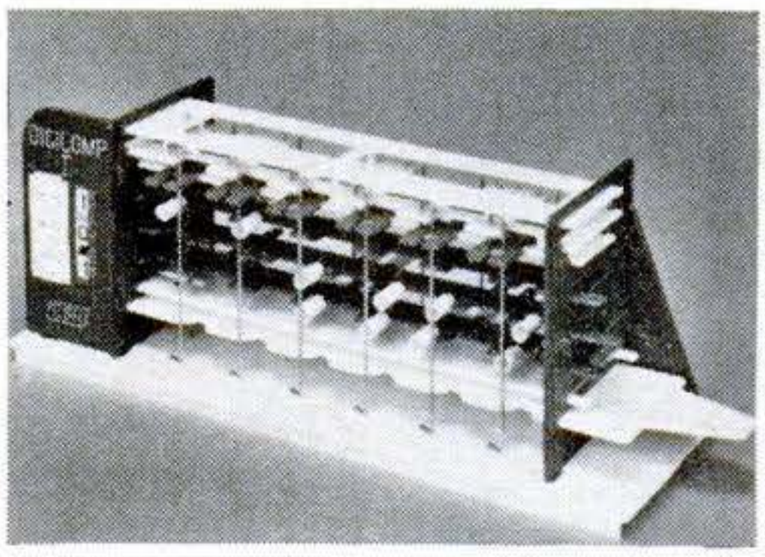

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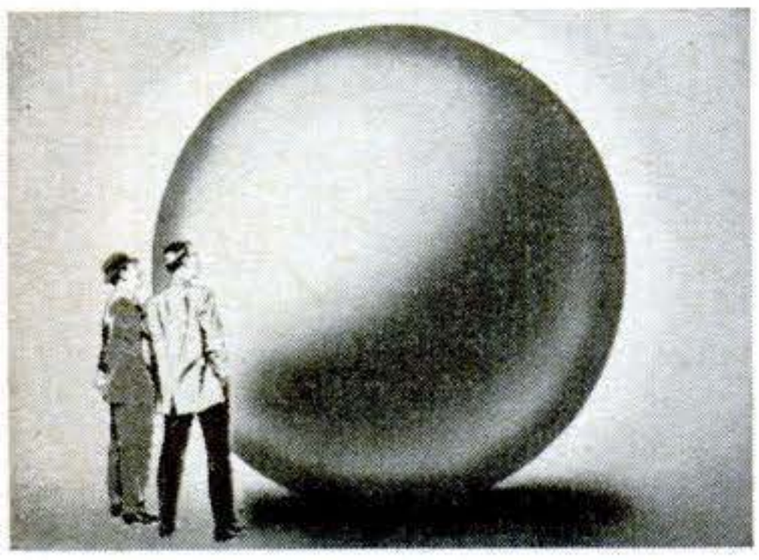

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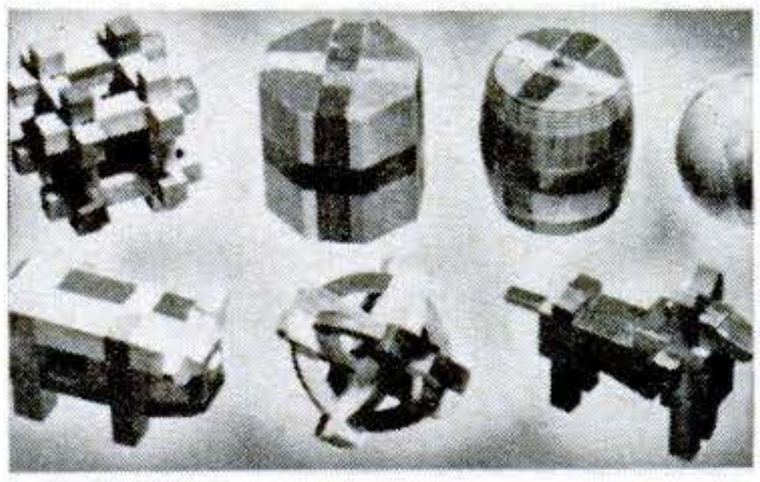

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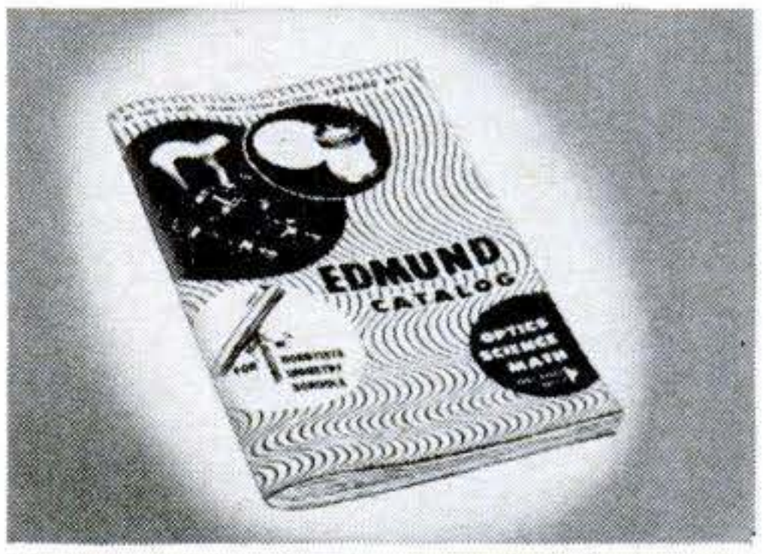

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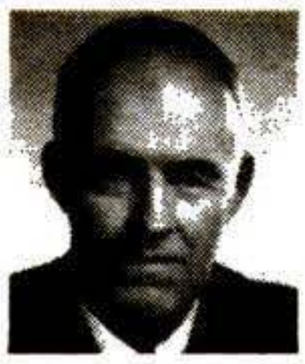

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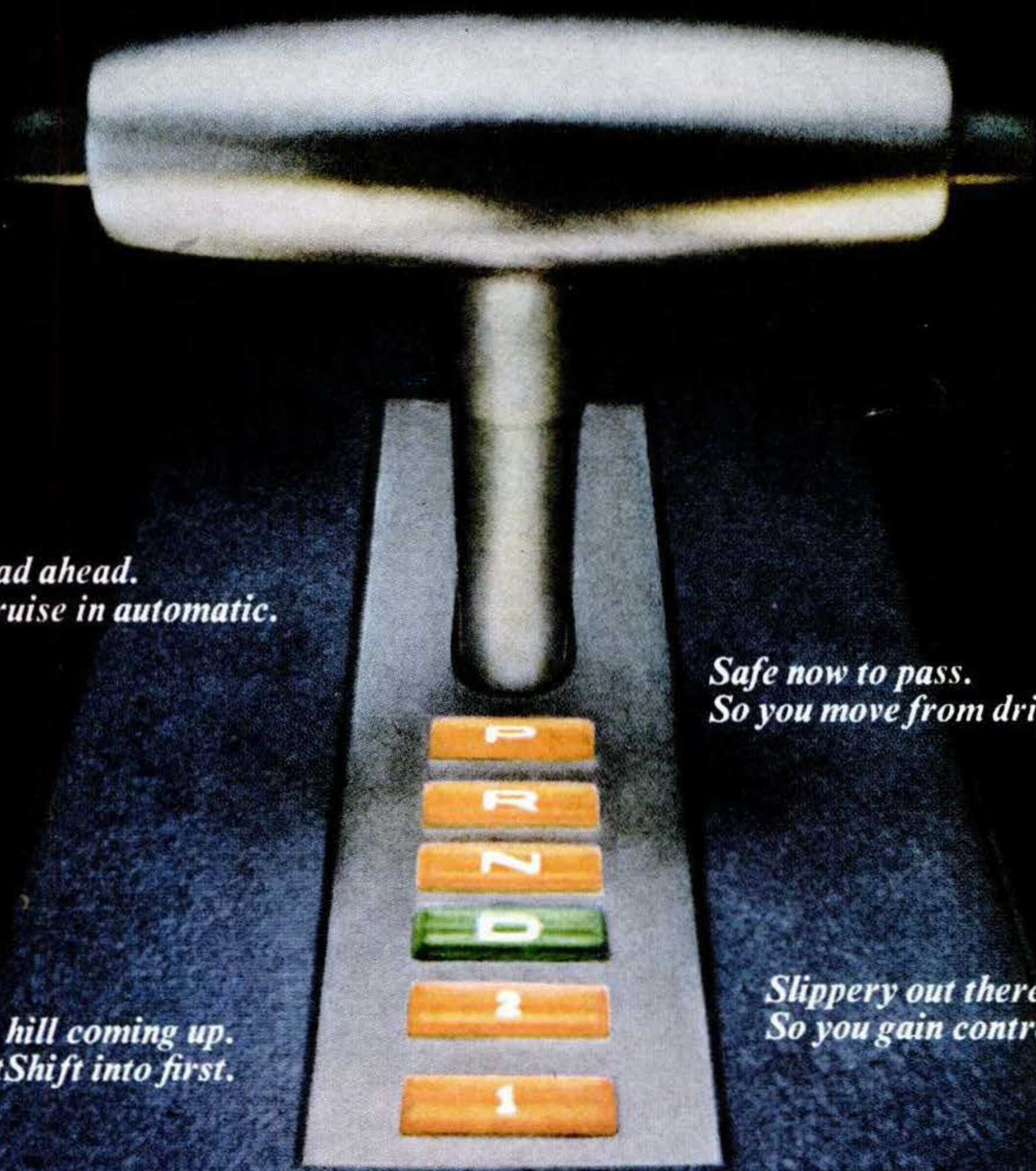

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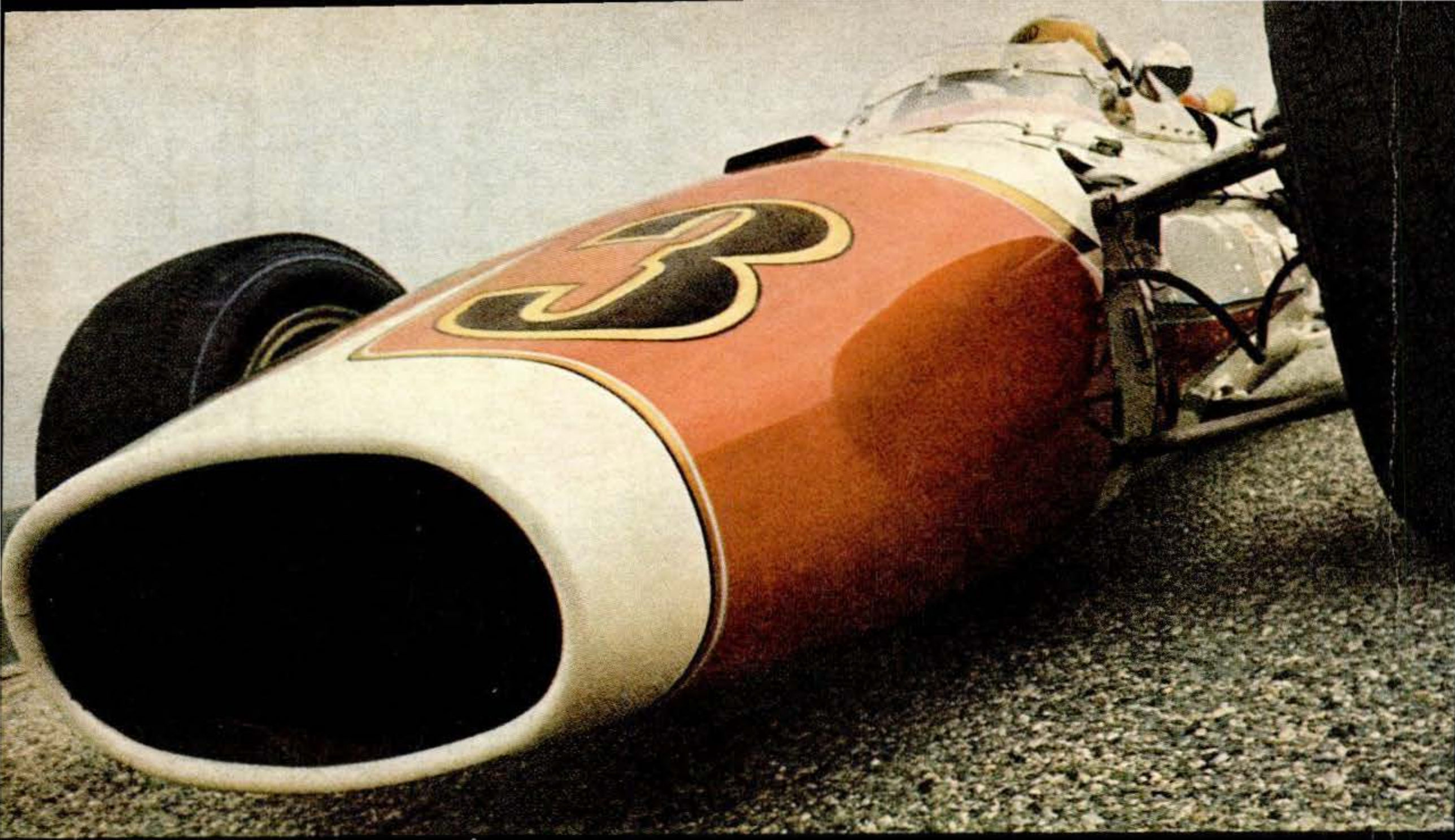

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It's got a $20,000 engine.
A $2,000 fuel injection system.
And the ignition coil? It's an Autolite coil.
Almost a carbon copy of the one you buy.
For under $10.

How come such a low-price coil in a high-price racing car? Because there is no better coil. Not at any price.

That's why Ford puts an Autolite coil—in fact, a complete Autolite ignition system—in every car they make.

Autolite Ford

Shouldn't this kind of coil be in your kind of car?

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